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TO THE EDITOR OF THE RAILROAD GAZETTE:

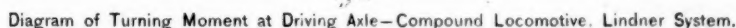
Our letter has been followed in your issue of Nov. 14, 1890, by a further communication from that gentleman, and while we have no desire to weary your readers by unnecessarily prolonging this discussion, we yet consider it our duty to demonstrate the fallacy of the arguments employed by Mr. v. Borries.

Although the starting gear, when thus arranged, gave in itself very satisfactory results, it required a certain amount of experience in its manipulation, since, should the regulator be opened too timidly when starting a heavy, tightly coupled train, it may happen, in the event of the high-pressure piston giving alone the motive impulse, that a back pressure is produced on the high-pressure piston, and that its power is thus diminished.

...to the employment of the present in-



Fig. 3.



Owing to this method, which is peculiar to Mr. Lindner's system of leading the auxiliary steam from the regulator, this latter, in the event of the low-pressure piston having to start, must be more than half opened before the piston can exert an impulse.

The starting of a tightly-coupled train thus always takes place smoothly, and without jerks, whether by means of the high-pressure or low-pressure cylinder. Besides this, any small movements of the locomotive by itself may be effected without any auxiliary means.

The circumstance instanced by Mr. v. Borries as creating an element of danger takes place equally with every compound locomotive fitted with an intercepting valve, namely, that when the low-pressure piston has to start, the valve chest of the high-pressure piston, being also filled with live steam, the latter piston continues the movement as soon as the high-pressure port opens, after the movement has commenced. The same thing occurs with every ordinary locomotive.

The numerous express and passenger locomotives constructed on the Lindner system on the Royal Saxon and Royal Bavarian state railways, where heavy trains have to be transported on steep gradients, fulfill all demands which can be made with respect to starting, working and safety during short movements.

The desire to take into account the undoubted fact that drivers have always been accustomed to open the regulator very slowly on first starting, and then gradually more and more as the locomotive begins to move, led at length to the improved system described below, which fully allows for this custom, and is now always adopted when fitting locomotives, the question of leading the auxiliary steam from the regulator now applying only in the case of express and passenger locomotives.*

By this improved system, instead of the auxiliary steam being led into the receiver direct, or to certain points in the high-pressure cylinder, and from thence into the receiver by the small equalizing slots of the high-pressure slide (a plan which has also been used with advantage for a large number of goods engines), the auxiliary steam pipe is led into the valve chest of the low-pressure cylinder, the admission of steam into the latter being so controlled by a part of the slide-frame that the orifice is only open so long as the steam is free to enter the low-pressure cylinder, and is closed as long as the low-pressure slide covers both the steam ports.

This, as will be evident from figs. 1-3, is effected in a very simple manner by the lug *E* on the bed of the slide frame being made identical in size with the outer lap *E* of the low-pressure slide itself.

What happens when a two-cylinder Lindner compound locomotive starts from various positions of the crank may be seen from the accompanying polar diagram of the tangential forces, which are caused at the periphery of the wheel when the engine is starting. Fig. 4 shows one of these for a Lindner express

locomotive of recent construction, with a following low-pressure crank, 12 atmospheres steam pressure, diameters of cylinders in the proportion of 1 to 2.2, and a maximum pressure in the receiver of 5.5 atmospheres. The path of the crank and the periphery *a* of the wheel are shown on a scale of $\frac{1}{30}$ natural size, and the tangential forces transmitted to the periphery of the wheel are shown as lines *b* extending outward from the circumference, each millimetre of their departure from *a* representing one kilogram.

The adhesion circle *c* corresponds to a tractive force of 4,000 kilograms equal $\frac{1}{4}$ of the adhesion weight, while the mean tractive force calculated from the dimensions of the locomotive according to the formula $z = \frac{0.5 \times d^2 \times l \times p}{D}$

(which is the formula for compound locomotives) is given at 3,700 kilograms, *d* and *l* representing the diameter and stroke respectively of the high-pressure cylinder, *p* the boiler-pressure, and *D* the diameter of the driving wheel.

For the conditions of starting with various positions of crank, four phases or periods must be considered for each semi-circle.

(1) Phases II-III and VI-VII:

Within these phases the impulse takes place with increasing force from the high-pressure piston alone without any back pressure, and as in every ordinary locomotive.

(2) Phases IV-V and VIII-I:

The impulse takes place with a force which increases within these phases, and is produced by the low-pressure cylinder alone, with at least the same force as in phases II-III and VI-VII, while the high-pressure piston is at the same time relieved by the small equalizing channels in the high-pressure slide. (See *Railroad Gazette*, Nov. 15, 1889.)

(3) Phases I-II and V-VI:

The impulse is derived mainly from the low-pressure piston acting with a great force, which, however, diminishes within the phases, while the high-pressure piston acts with small but increasing force, and the motive effect of these two forces are combined.

(4) Phases III-IV and VII-VIII:

The impulse, where the auxiliary steam is led from the regulator, is derived solely from the high-pressure piston with a great force, which diminishes somewhat within the phases, as represented by the pressure line *b* 1.

Where the auxiliary steam is led from the main steam pipe, the low-pressure piston also works simultaneously with small but increasing force. The pressure which is then developed on the low-pressure piston acts back upon the high-pressure piston; but, since the high-pressure crank is in the most favorable position, the impulse is speedily given by the high-pressure piston, and the motive effect does not in any case fall below the minimum values at the commencement of the phases indicated by (1) and (2) where only one piston is working at a time, but will correspond with the pressure line *b* 2.

We beg to draw attention to the fact that all these methods of construction are protected by patents either already granted or applied for, in respect of the latest improvement in Germany, America and other countries, and that, as the German patents have to go through a process of proof, as regards novelty of invention and publication prior to date of seal, all appeals and claims against them, including those of Mr. v. Borries or his representative, were dismissed by the German Patent Office, these Lindner inventions, as can easily be demonstrated in detail, being entirely distinct from the inventions previously brought out and recorded by Mr. v. Borries. For this reason, therefore, the conclusion drawn by Mr. v. Borries, namely, that no starting gear which is unprovided with an intercepting valve can ever give satisfactory results, simply because he had himself been unable to obtain such results, is also untenable.

The great success of the Lindner system will also show itself as soon as the locomotives now fitting in America are ready, in their case as it has done on all other lines on which it has been tried, and on several of which the authorities have been thereby led to its exclusive adoption.

Up to the end of 1890, the number of engines on which the system either had been fitted, or was in course of fitting, amounted to 165, and included locomotives of all types and gauges on various descriptions of railways and in various countries.

In the case of some locomotives on the Russian Vladikavkaz line, as referred to so disparagingly by Mr. v. Borries, had any want of success arisen, it could not be laid to the charge of the invention itself, because, as it happened, the Lindner system was applied by the Kolomna factory, near Moscow, when building these 35 heavy goods engines, without consulting the inventor and merely on the good reputation it enjoyed. In reply to our inquiries, we have, however, now the conclusive evidence of the locomotive superintendent of the railway, praising the action of the Lindner system as "perfect, and giving every facility for starting in any position," while, from the remarks of Mr. v. Borries, we may take it that the engines were designed with two small cylinders (as is generally the case in first experiments with compound locomotives), so that on the steep gradient they had to be kept in full gear. In such a case, with the Lindner system, live steam enters also through the auxiliary steam supply into the low-pressure cylinder,

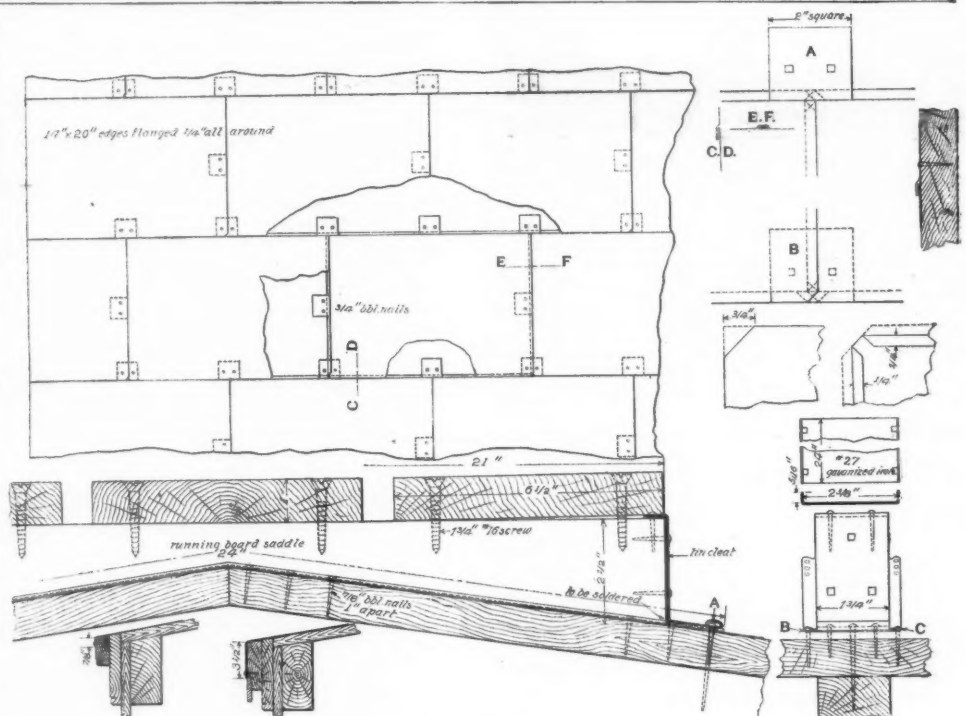


Fig. 4—Roofing.

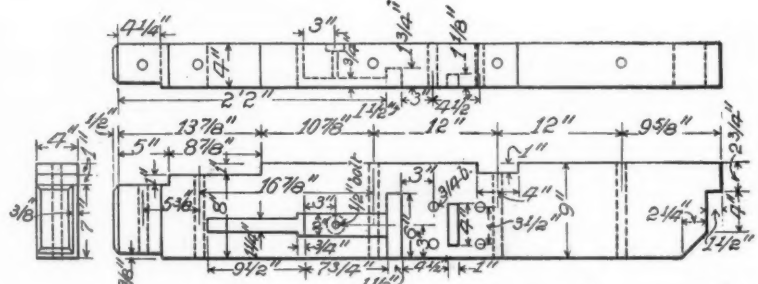


Fig. 11—Draft Timber.

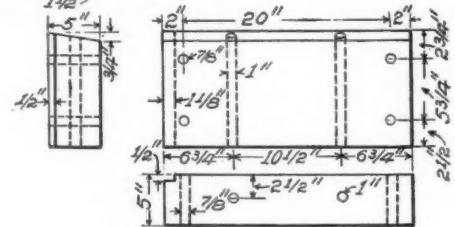


Fig. 12—Buffer Block.

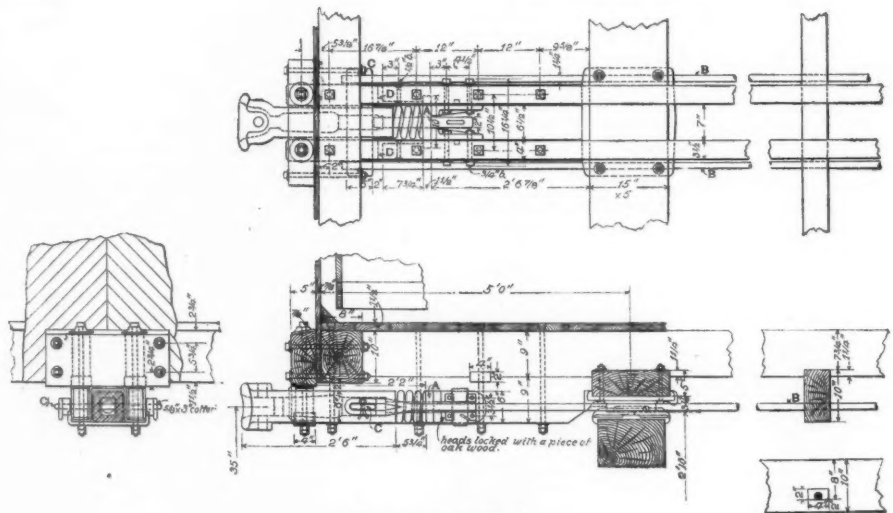


Fig. 13—Draft Rigging.

DETAILS OF 50,000-LB. BOX CAR—BALTIMORE & OHIO RAILROAD.

der, and thus the effect of the latter is greatly increased as compared with that of the high-pressure cylinder. By this means the tractive effect of the locomotive, in case of need, is considerably increased, while engines of similar dimensions, if fitted with v. Borries' intercepting valves, cannot, under any circumstances, attain such results, which exceed those to be expected from the dimensions of the engine.

That in the working of an engine constructed on the Lindner system it is impossible for the small slits on the high-pressure slide, which move over the steam ports at the maximum velocity of the slide itself, to cause any appreciable escape of steam such as Mr. v. Borries charges them with doing, is evidenced by indicator diagrams, even at low speeds, as these always show a regular curve of expansion; and we also question the conviction

of Mr. v. Borries that through an aperture of $\frac{1}{1000}$ of the area of the high-pressure piston, in the infinitely small period of time during which the communication is open, any appreciable admission of steam can take place.

Any such effect of these little passages during the working of a locomotive becomes a vanishing quantity when compared with the effect in a similar sense of the negative inner lap of the high-pressure slide, as also employed by Mr. v. Borries.

HOPE & CO.

50,000-lb. Box Car, Baltimore & Ohio Railroad.

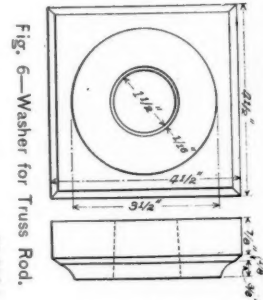
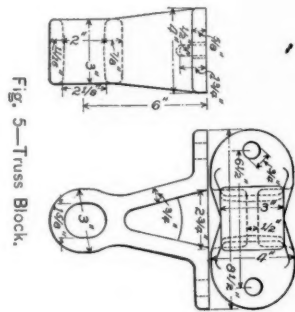
It was generally believed among railroad men that the rolling stock on the Baltimore & Ohio road was rather out of date at the time of the reorganization; hence the

new designs of rolling stock are looked upon with considerable interest. For some time past Mr. J. T. Odell, General Manager, and Mr. E. W. Grieves, Master Car Builder, of the road, have been working upon a new design of a standard 50,000-lb. box car, the principal features and general plan of which are shown in the accompanying illustrations.

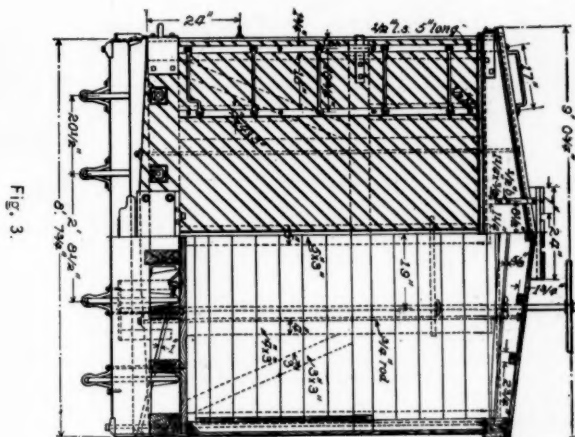
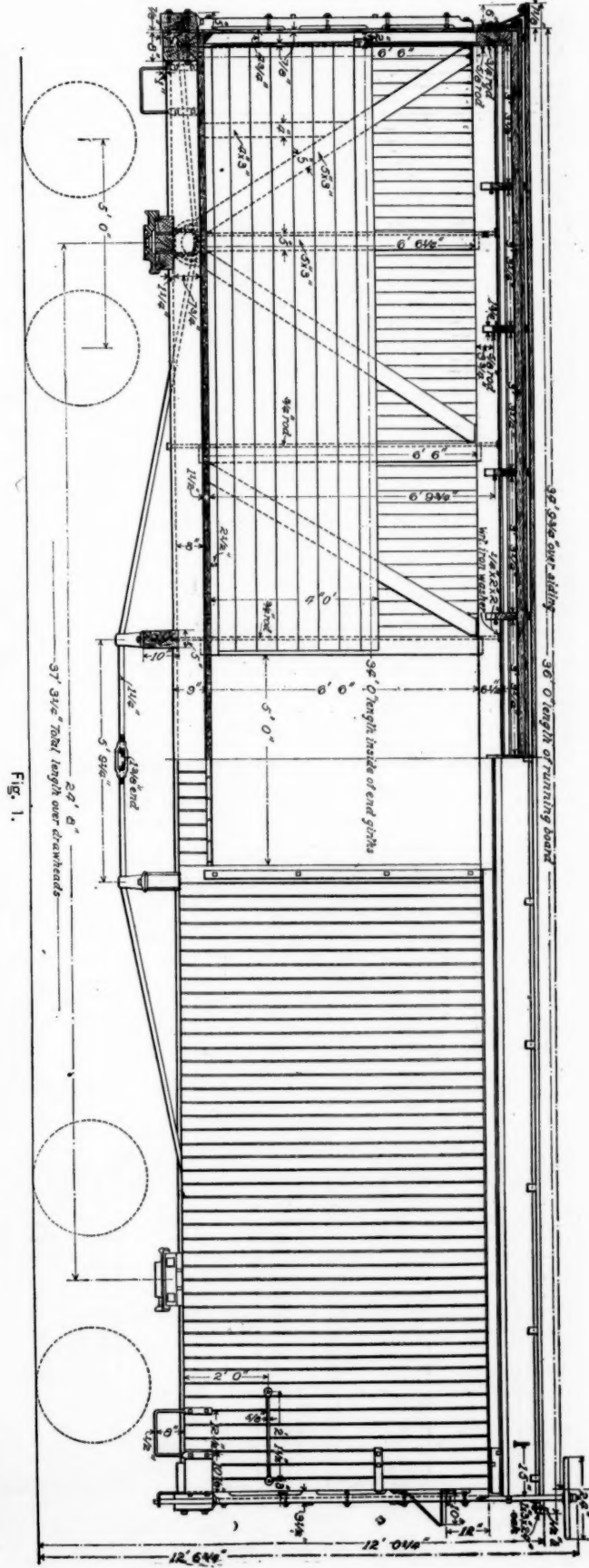
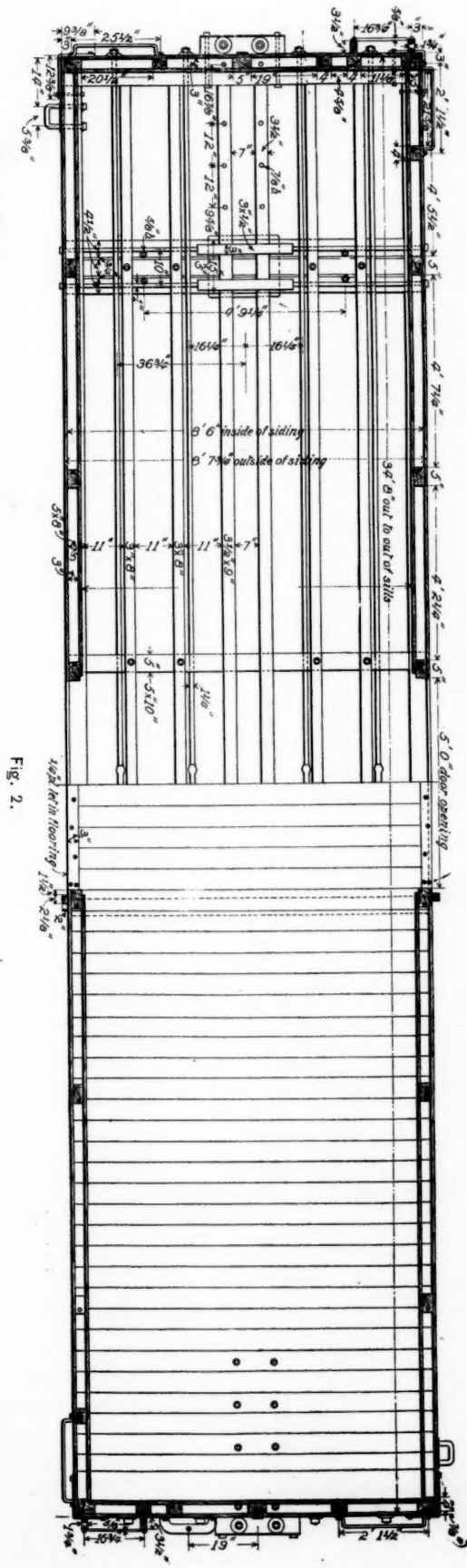
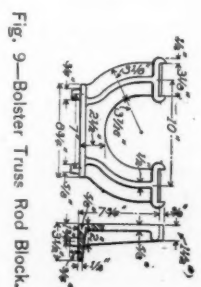
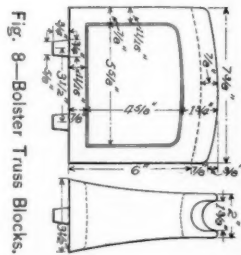
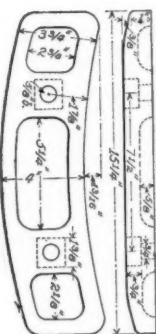
In the side elevation, fig. 1, and the plan and end elevation, figs. 2 and 3, it will be seen that the sills are eight in number, placed about 11 in. apart. The centre sills are $3\frac{1}{2} \times 9$ in., the outside sills 5×8 in. and intermediates 3×8 in. The body bolsters are made of three pieces of wood $4\frac{1}{2} \times 5$ in., with two iron plates between. The end sills are 8×10 in. and the side posts and braces 5×3 . The roof is covered with tin, and the method of attaching the running board and covering jet is shown in fig. 4. The styles of joints are shown in the details at C D, E F and A.

The truss block is so made that the truss rod passes through it and cannot drop in case the turnbuckle becomes loosened. This block is shown in detail in fig. 5.

Fig. 6 shows the large cast-iron washer on the end sills for the truss rod. These washers are outside of the sheathing. The side bearing, and the truss blocks for the longitudinal truss rods on the body bolsters are shown in figs. 7 and 8. The body bolster truss is ingeniously arranged to avoid cutting the flooring. It will be noticed that a common trouble with these trusses—namely, the sinking into the wood where they pass over the centre sills—is avoided by the use of a strut, shown in fig. 9, which is seated, as shown in fig. 3, on the body bolster just outside of the centre sills and extends up to the top of that sill and receives at that point the $3 \times \frac{1}{2}$ in. straps which pass over the sills and receive the truss rods. These straps and the rods are shown in fig.



50,000 LB. BOX CAR—BALTIMORE & OHIO RAILROAD.



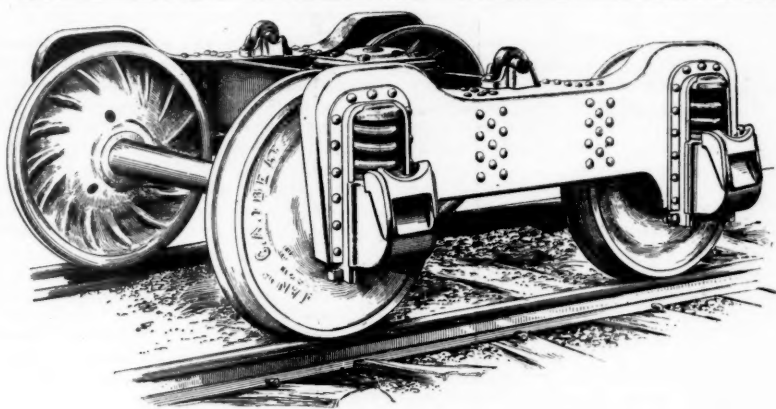


Fig. 1.

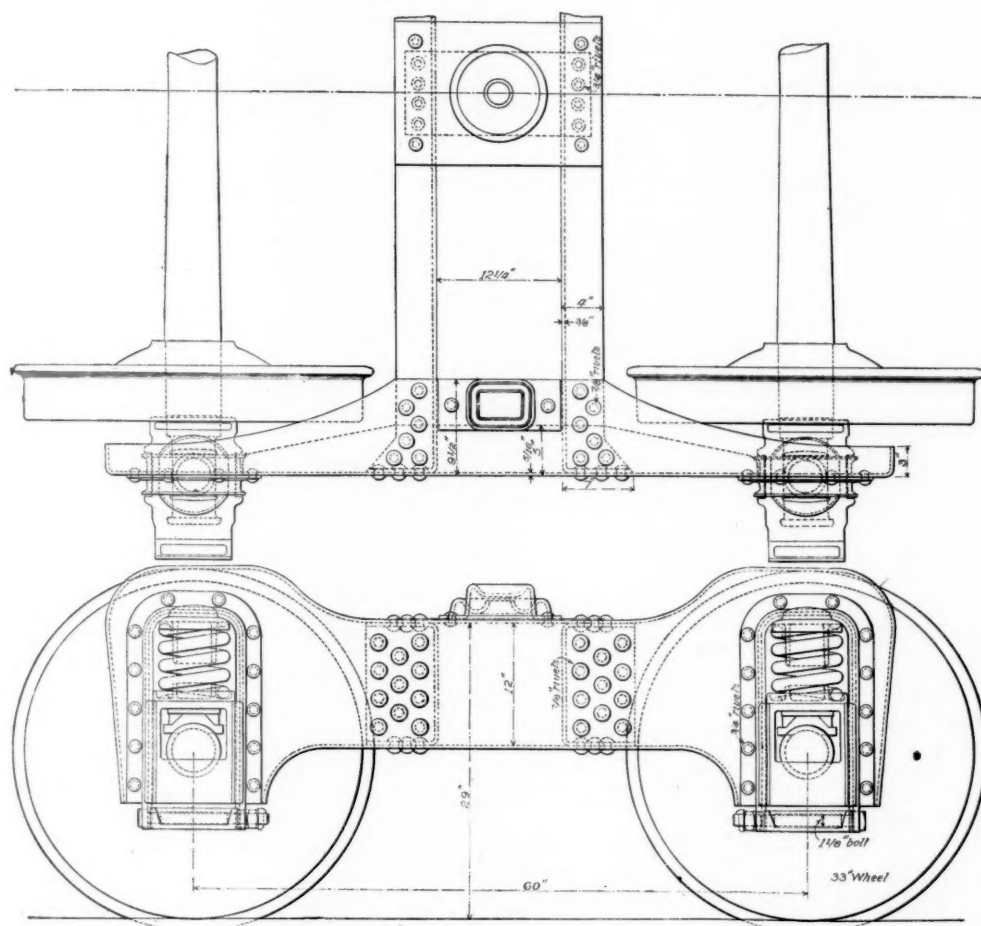


Fig. 3.

FOX SOLID PRESSED STEEL TRUCK.

this design, by the Fox company, and it is claimed that there will be no working at the joints, as they are stronger than the plates, hence the plates must break before the joints will move. The rivets are $\frac{1}{2}$ in. in diameter, and have the largest possible heads consistent with good hydraulic riveting.

Another claim made for this truck is ease of inspection. All parts are visible from the outside, and there are fewer parts to inspect than on a diamond truck. Good material is assured in such construction as this, because when steel is sufficiently good to be worked in dies at one heating into the forms shown it must be necessarily of a tough quality.

According to tests made of pressed steel trucks, the carrying capacity is more than twice that of the diamond truck for equal weight, and the high class of material which must necessarily be used will, it is claimed, give greater reliability.

Pressed Steel in Car Construction.*

At the request of your secretary I have prepared a brief account of what has been done toward the introduction of pressed steel shapes in car construction. As it has been less than three years since any steps in this direction have been taken, the amount of work accomplished is limited as compared with the vast possibilities in this direction; but the progress made has been quite large and satisfactory when we take into account the fact that it is an innovation on the old practice of using cast iron.

From the best information that I can gather I estimate that about 12,000 tons of pressed steel has gone into car construction during the past 2½ years, consisting of spring plates, journal box lids, centre plates, stake pockets, side bearings, drawbar attachments, dead blocks, corner bands, etc., and from all that I can learn these various articles are doing good service.

The greatest drawback to the introduction of the various articles is the multitudinous number of sizes of

the same article, the impossibility of getting the gentlemen constituting the mechanical departments to see eye to eye in the matter of standards. As one of them said to me a few days ago while going through our works, "We meet in convention, discuss and adopt standards, then go home and keep on doing as we please." As an illustration of this, the Schoen Manufacturing Company has between 70 and 80 sets of dies for centre plates, and about 100 sets of dies for stake pockets alone. There ought not to be any necessity for more than one-half dozen sizes of either of these articles. This same difficulty follows in nearly everything about a car, and it is readily seen that the various articles cannot be produced as cheaply as they could if this large expense for dies was eliminated from the cost. Besides, the cost for repairs is largely increased because of the delays occasioned in getting material for repairs for foreign cars having different patterns. You are all, of course, familiar with this trouble in the present practice in patterns for cast iron, and this knowledge should influence you very favorably toward the adoption of standards in pressed steel in its early stages, thus avoiding what in the future would be a constant source of expense, as is now the case in the old practice.

The advantage of using a homogeneous metal in car construction, such as we have in low carbon steel, is certainly beyond comparison with cast iron. We have a metal that will withstand shocks without injury far beyond that of cast iron, and in consequence of this the expense for repairs is largely decreased.

The weight of the various articles in pressed steel, which are substituted for castings, will average about one-third the weight of the cast iron displaced, and, assuming that there have been 12,000 tons of pressed steel articles used up to the present time, as stated above, it has displaced 36,000 tons of cast iron. Deduct the weight of the steel (12,000 tons), and we have a net saving of 24,000 tons of dead weight. It costs just as much to haul that 24,000 tons of surplus weight as it does to haul that amount of paying freight. I have made up a statement which shows the saving occasioned by this reduction in dead weight. The figures on which the calculation is based are taken from the last report of the Pennsylvania Railroad Company, which, I presume, is about a fair representation of the average cost throughout the country, and I have taken the car mileage at 10,000 miles per annum. I have assumed for the purpose of calculation that the weight of the car is about equal to

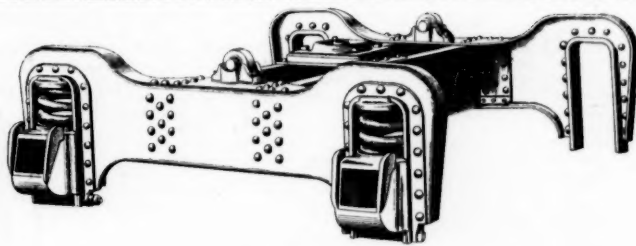


Fig. 2.

the average load hauled. Of course, the car does not weigh as much as it is capable of hauling, but the average load hauled will not vary greatly from the weight of the car, except where the cars are in special service, such as hauling coal; but assuming for the purpose of calculation that the weight of the car is equal to the average load hauled, the cost of hauling the car would be one-half the total cost for hauling paying freight. The Pennsylvania Railroad Company's last report states this to be 0.473 of a cent per mile; one half of this, 0.236 of a cent, would be the cost per ton per mile for moving what we might term the dead weight, 24,000 tons, which represents the saving by using pressed steel, at .236 of a cent per mile, or \$56.64. Taking the car mileage at 10,000 miles per annum, this, at \$56.64 per mile, equals \$566,400 saved by substituting pressed steel for cast iron. This is a very large sum, and it might be modified somewhat by deducting the general expense account, but they are the best figures I could get as a basis. You will bear in mind that this is for one year only. When we consider that the saving continues on throughout the entire life of the car, it is enormous, and is well worth the careful consideration of motive power men. If the life of the car be taken at 12 years, it would amount to the total of \$6,796,800. Large as this saving in dead weight is, it is insignificant in comparison with what may and, in all probability, will be accomplished during the next five years, as the introduction of this material is meeting with almost universal approval, its advantages being so obvious.

Indeed, I predict in the near future that a steel car throughout will be the popular car. The cost of steel is growing less from year to year, brought about by improved methods of manufacture, until even now a steel car can be built very closely approximating the cost of a first-class wooden car as at present constructed. The Harvey Steel Car Company, of Chicago, I understand, is at present engaged in building twenty-five of its steel cars. The Fox Pressed Steel Company is engaged in developing its pressed steel car truck, and has the utmost faith in its success. The Schoen Manufacturing Company is at present engaged in making preparations to build a number of steel cars and proposes to put them in service and let them run and develop any possible weak points, or mistakes in design, with a view of preparing to build these cars in a regular way. It is confidently believed that a steel gondola car of 30 tons capacity can be built thoroughly well, and the weight will be less than 19,000 lbs. This is a saving in dead weight of several thousand pounds over the ordinary wooden car; and as a vehicle for the transportation of freight, its value is as much greater than a wooden car as the cost of transporting the dead weight in the wooden car would amount to, less any differences that there might be in expense of keeping the car in repair; and it is fair to presume that the cost for maintenance would be less than it would be in a wooden car.

The constant reduction in cost of steel, and the growing scarcity and consequent increase in cost of timber; the reduction in dead weight; the probability that they will last twice as long as a wooden car, are most certainly strong reasons why all developments looking to the introduction of a steel car, either in whole or in part, should and will be viewed with more than ordinary interest by railroad men and investors in railroad securities, and it is to be hoped that the committee appointed at the last Master Car Builders' Convention, to look into and report on this question, will furnish some valuable information on the subject.

The art of shaping steel in dies is a very interesting study. Many things can be made from pressed steel of considerable thickness that the ordinary worker of metal would hardly credit. This is due to the developments in the art partly, and partly to the uniformity in quality and cheapness of the steel as produced to-day. A few years ago this industry could not have been developed because of the high cost of material. To-day, however, steel shapes can be substituted for castings without increasing the cost of construction, except in cases where extremely light castings are used.

DISCUSSION.

MR. BARNES [Mr. Barnes described drawings of a pressed steel truck made by the Fox Company]: Probably the Fox Steel Company has the largest set of presses in the world. They are adapted to take sheets as large as 24 ft. x 9 ft. The largest work they have made is galvanizing pans for wire-works. These pans are made of plates about 1 in. in thickness, 18 ft. in length and 6 ft. in width.

Of course, a railroad company hates to go largely into any new material if there is any chance of monopoly in it. It can hardly be said that there is a monopoly in pressed steel, as there are in this country now, in the form of pressed steel works and stamp works, about a dozen different manufacturers, and the locomotive builders in many instances are making their own pressed steel boiler fronts, cylinder head casings, etc., with good success.

The first use of pressed metal in car construction in this country that I can find record of was on the Chicago & Alton, where they used centre plates made of iron about $\frac{1}{2}$ inch thick, forged under steam hammers at the works now owned by Carnegie & Phipps, of Pittsburgh. Since that time, the forms of centre plates have been changed materially, and certainly the present forms are very much superior to the old ones.

I think, in looking over these drawings and photographs of the truck, you will notice that it looks very strong; and it certainly is, as it has a carrying capacity over double that of the ordinary truck and a thousand pounds less material. Of course, in the use of such material for railroad work, there is the old objection raised of difficulty of repair; but as the greatest cost of repairs results from the looseness of the parts, and as in this truck they cannot get loose, it would seem that repairs would be less than with the ordinary truck. In wrecks it would be easier probably to take apart the ordinary form than this one; but the number of wrecked trucks on a railroad during a year in proportion to the total number in use is very small, and I therefore think

*Read before New York Railroad Club, March 19, 1891, by Mr Chas. T. Schoen, President Schoen Manufacturing Company.

I am right in saying that a truck should be built to be used and not to be wrecked.

Mr. POMEROY: I would like to ask if in this process where the flange is made there is any thickening?

Mr. BARNES: That can only be done by two pressings. Wherever a very difficult piece is to be made it is first pressed to thicken up the thin places, then it is pressed a second time. During this second pressing a very sharp corner can be obtained.

The CHAIRMAN: Do you not think that you manufacturers are partly to blame in the matter of stake pockets? I see no good reason why stake pockets of one pattern could not be used all over the country. I should think in making stake pockets you would recommend a certain kind. I presume the majority of railroads send in orders for such stake pockets as they have been using.

Mr. SCHOEN: I started out to do that, but I wanted to try to make a living as I went along, and I found that they were not very much interested in the thing unless they could interchange with their old cast iron ones, so I found it cheaper to make dies.

Mr. BARNES: There are a great many parts that cannot be made in pressed steel that are now made in malleable iron. The introduction of pressed steel will in no wise do away with malleable iron. Pressed steel is quite limited in its scope. It is almost impossible to put ribs in parts of it and to make some kinds of sharp corners. In answer to the question about how sharp a corner can be made in pressed steel, I will say it is very hard work to get the smallest radius in material of $\frac{1}{4}$ in. thickness less than $\frac{1}{4}$ of an inch. That would make the outside radius $\frac{1}{2}$ in. provided the metal did not draw around the corner. It is the shape of the metal on each side of the corner that causes drawing at the corner.

Mr. SCHOEN: I think we get what might be termed, practically speaking, a sharp corner on the inside where the guide bar column works. We make them in two operations. After you get beyond one operation in pressing it partakes somewhat of hydraulic forging to get the corners square and nice.

Mr. PORCHER: I would like to ask Mr. Barnes about the rivets; whether it is difficult in these trucks to keep them tight, and if they do not shake loose; whether he finds the size of the rivets has anything to do with it?

Mr. BARNES: The ordinary rule for rivets would be $\frac{1}{4}$ of an inch. To get a good tight job with these trucks, the rivets are made $\frac{3}{4}$ of an inch diameter with large heads and driven by hydraulic pressure.

Mr. PAXSON: I think that we have running upon the Philadelphia & Reading about 6,000 cars on which we use steel centre plates and steel stake pockets, and only know of one of the centre plates being injured, and that was in a break-down. I don't know that we have had to change any centre plates at all. We have, I think, had collisions that have broken some 8 or 10 of the stake pockets, and that was all.

Mr. WEST: I would like to ask Mr. Paxson whether they had any trouble with shearing of the bolts?

Mr. PAXSON: No; the flanges of our centre plates held them; we don't care very much about the bolts.

Mr. BAKER: I would like to ask Mr. Barnes if he has any of these trucks off the track and under hard usage, and how much they would stand?

Mr. BARNES: Several trucks have been broken by purposely overloading the cars and running them at high speed around a yard curve. Those trucks failed by rolling over—flattening down. The load on each truck was about 90,000 lbs. It is expected that a truck, as it is shown here, with the springs over the boxes, can carry about 90,000 lbs. That would make it good for a car of 180,000 lbs.; that is a breaking load.

The CHAIRMAN: I would like to ask what parts of the car now in use can be made of pressed steel; that is, in what parts steel can be substituted? You have named stake pockets and centre plates.

Mr. SCHOEN: I cannot go over the list exactly; draw-bar attachments and bolts, guide-bar columns, guide-bar plates—pretty nearly all the castings about a car. There are only some few which would be too difficult to make.

Mr. PORCHER: Have you succeeded in making journal boxes?

Mr. SCHOEN: No, sir; not commercially. We have been figuring on it.

Mr. BARNES: Pressed steel journal boxes are largely used in England. They weigh about one-third as much when of the steel as when of cast iron.

Mr. SINCLAIR: I think this subject of pressed steel for car construction represents one of the most thoughtful and progressive phases of railroad work of the present time. There seems to be no reason whatever why there should not be a standard centre plate. There is nothing about a car that can be standardized to greater advantage and with less difficulty than a centre plate, and it is not the right way to be silent and let the thing go and expect that the remedy will come. It is very desirable that those connected with car designing should be urged to agree on standards as much as possible and use the adopted standards when they can do so without disadvantage to themselves or to the company. The centre plate is only one phase of many. One of the latest standards adopted is an axle for a 60,000-lb. car. One would imagine, after all the talking which has been done of the advantage of having standards standard, that they would certainly order nothing more than one form of that axle; yet, not more than 10 days ago, I was talking to a gentleman connected with a forge company that makes car axles, and he told me that they have already had 20 different forms of the new Master Car Builders' axle. I think that is disgraceful to all concerned, and it is the duty of this club and of all similar organizations to do their best to bring about a reform.

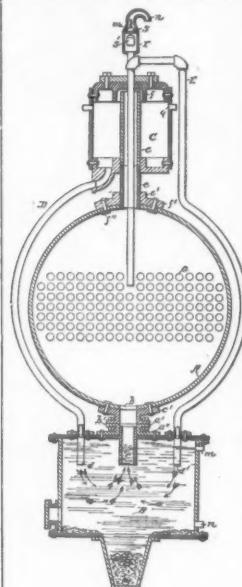
The CHAIRMAN: The subject for the next meeting is the Interchange Rules, and I hope all the railroad men present will take that subject up and look over the rules and come here, and then we will have a good meeting. There are many things in those rules that should be changed, and there should be some additions; and I hope you will all come prepared.

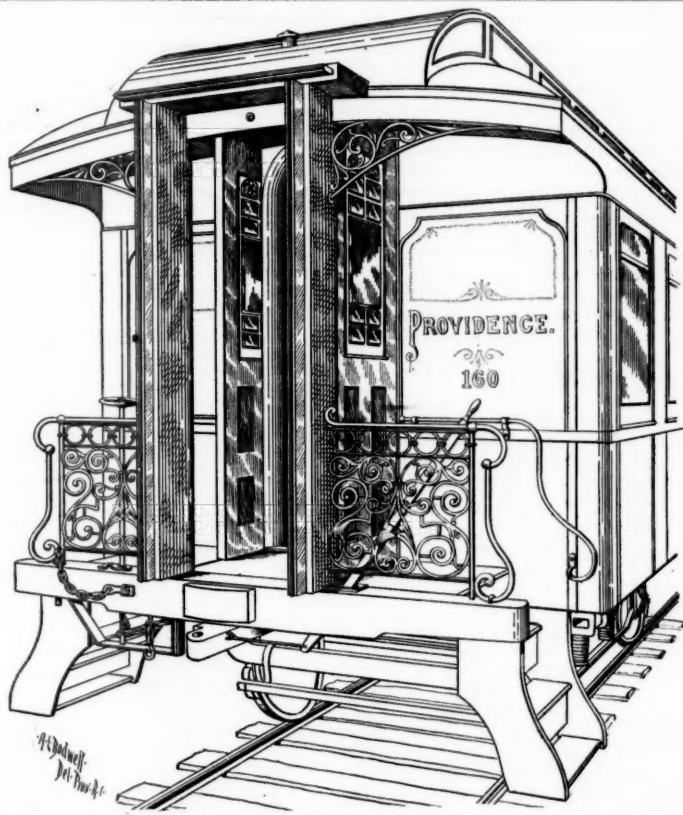
Feed-Water Heater and Purifier.

We illustrate a new feed-water heater and purifier which has been recently tested on the Long Island Railroad with good results both as to immediate economy of fuel and protecting of the tubes from scale, that is naturally deposited upon their heated surfaces, when nothing is done to free the water from the impurities it holds in solution and suspension.

Fig. 1 is a cross section of the device and fig. 2 a side elevation as applied to a locomotive. Referring to fig. 1, a supplemental dome C is attached to the top of the shell at any convenient point. The feed water is deliv-

ered into the steam space of this dome by the pumps or injectors at the points g g, and this steam space is connected with that of the boiler proper by the pipe e, so that the steam rises to the top of the dome through any water that may be standing therein.





HOWARD'S VESTIBULE.

danger attending the use of iron gates. There is hardly a pattern in use which is not liable to be so jammed in case of a collision as to impede, if not prevent, the egress of passengers. A few years ago one was invented in this city which was beautiful in style and ingenious in its combinations. It was well calculated to make a favorable impression at first; but when it was considered that the chances were that it would fasten the passengers in if there was a serious jam, it had more the character of a death-trap than anything else. Clearly, there should be nothing in the way of rapid egress which could not be removed with the axe carried in the car."

Prospects of the Use of Aluminum in Railroad Work.*

In a lecture which I gave before the Boston Society of Arts last month, I commenced as follows: "The metal aluminum has certainly not been 'damned by faint praise.' On the contrary, from my experience as the president of an aluminum manufacturing company which has been endeavoring for the past two years and over to sell the pure metal in the markets, and to introduce it into the arts and manufactures of the country, I have to state to you my conviction that one of the two chief difficulties which have been encountered and which to-day retard and restrict the use of the metal, is the extravagant, erroneous, and in many cases misleadingly misleading claims which have been made as to the properties of the metal. These have received wide circulation, not only through the daily papers but, I am sorry to add, through many technical and scientific journals as well. The other difficulty is the almost equally widespread, and so far equally extravagant and misleading claims, by inventors, of processes for the manufacture of aluminum at remarkably low prices."

In stating some of the prospects which I consider the metal aluminum has for railroad work to-day I wish to be very conservative in what I say, and to call attention at the outset to the statement made in the title, that it is simply the "prospects" of aluminum, and not the actual operations that I personally know have been successfully carried out with aluminum in railroad work, except in such cases as I shall specifically state from my own experience.

The properties of aluminum which will probably give it the greatest availability for use in railroad work are:

1. Its relative lightness; the specific gravity of aluminum being about 2.6. The weight of a given bulk of aluminum being 1, iron is 2.9 times heavier, steel 3 times heavier, copper 3.6 times heavier, nickel 3.5 times heavier, silver 4 times heavier, lead 4.8 times heavier and gold 7.7 times heavier. Most woods that would be used for structural purposes are about one-third as heavy as aluminum.

2. Its non-tarnishing quality as compared with other metals used in railroad work; aluminum not being acted upon by sulphur fumes at all, and being very much more slowly oxidized by moist atmospheres than most of the metals.

3. Its extreme malleability.
4. Its easy casting qualities.

5. The influence of the metal in various alloys will give it advantages, some of which I will try to enumerate and call to your attention.

6. Its high tensile strength and elasticity when weight for weight of the metal is compared with other metals, and especially when alloyed with a small percentage of titanium, silver or copper and properly worked by being rolled or hammered or otherwise drawn down.

7. Its high specific heat and electrical and heat conductivity.

Unfortunately, aluminum is not, section for section, as has been widely claimed for it, comparatively a very strong metal. It is only about as strong under tensile strain, section for section, as cast iron, and has less than one-half the strength of wrought iron, under ordinary

conditions. Under compression the metal, unfortunately, has a very low elastic limit, although its extreme ductility allows the metal to flow upon itself so freely as to make it for some special purposes a very safe metal to use in compression. I show a series of cylinders of 1½-in. diameter, which have each had a compressive strain of 200,000 lbs. applied to them, together with the result of a compression strain of 180,000 lbs. upon similar cylinders of cast iron.

The same remark applies to transverse tests on aluminum. It is not a rigid metal at all, and bends under transverse strains very readily. I append a table of results which, from our experience, I believe will show about the average tensile and compressive tests of commercially pure aluminum:

	Lbs.
Elastic limit per square inch in tension (castings).....	6,500
" " " " (sheet).....	12,000
" " " " (wire).....	16,000-30,000
" " " " (bars).....	14,000
Ultimate strength per square inch in tension (castings).....	15,000
" " " " (sheet).....	24,000
" " " " (wire).....	30,000-65,000
" " " " (bars).....	28,000
Percentage of reduction of area in tension (castings), 15 per cent.	
" " " " (sheet).....	35
" " " " (wire).....	60
" " " " (bars).....	40

Elastic limit per square inch under compression in cylinders, with length twice the diameter..... 3,500
Ultimate strength per square inch under compression in cylinders, with length twice the diameter..... 12,000
The modulus of elasticity of cast aluminum is about 11,000,000.

It will be noted that the tensile strength of aluminum wire runs up very considerably over that of the rolled metal. This is due to the peculiar property of aluminum to harden under work. The metal requires frequent annealing in rolling; and if it is to be drawn down in wire with as little annealing as possible, the tensile strength is increased very considerably. This property of the metal is increased especially if the aluminum is alloyed with a small percentage of copper, titanium or silver.

It will be perfectly feasible to produce a wire of aluminum alloyed with a few per cent. of silver, titanium, or copper, which will have a tensile strength of 80,000 lbs. to the square inch, and which will have, weight for weight with copper wire, an electrical conductivity of 170 to that of copper being 100. When it is taken into consideration that the copper will only have a tensile strength at maximum of, say, 30 lbs. per sq. in., against the 80,000 lbs. strength of the aluminum-titanium alloy, and when the further fact that iron or soft steel wire has only a conductivity of 17 in the same scale, and has a less, or at most only an equal tensile strength per inch with the aluminum-titanium alloy, a wide field for usefulness for electrical conductors seems opened for the metal, even at present when the price of the wire of aluminum-titanium alloy will necessarily be considerably higher; but when such an alloy can be produced in fine wire at a price ten times that of the iron wire, pound for pound, then as the section can be reduced the aluminum-titanium alloy will be the cheapest, as well as the most advantageous, for electrical conductors.

To return to the properties of the metal taken in the order as I gave them of their adaptability for use in railroad work:

First, as to lightness, I will cite the use of aluminum for the purpose of valves where lightness will be of value as decreasing the inertia or the momentum of the mass of the valve (and I can tell you that aluminum slide valves are now under trial, I understand, with very satisfactory results), to control the passage of the air from the storage cylinders to the brake cylinders in the new and larger form of the Westinghouse air brake now under construction, they having reached the point where the inertia to be overcome of the heavy iron or brass slide valves is a very serious consideration. This inertia is decreased one-third by the use of the aluminum, the question of wear being now the only one to be decided about; and if the castings already in use are proved to wear too rapidly, I feel confident that the addition of a little copper to the metal and casting the valves nearly to size and drop forging them to finished shape, in order to further harden them, will produce a metal that will be entirely satisfactory; and, indeed, so far as we have heard, the valves of the

pure metal in sample castings seem to be wearing very well.

Wherever momentum has to be overcome, as in the reciprocal parts of many forms of machinery, aluminum can be advantageously used.

A use of the metal, due to its lightness, which may be of more or less interest to railroad men, is in windmills, where the metal has already been proved advantageous in both the fan blades and the frames.

Considerable work has been done in the way of using thin sheets, rods and tubes of steel for passenger coaches, which, with suitable non-telescoping devices, bids fair to be a very safe car, preventing serious accidents in collisions. The use of the lighter metal, aluminum, for the same purpose may become a feature of the future; and here the remarkable capacity of the metal to flow on itself, and to upset or bend under sudden impact rather than to fracture, as cast iron or even steel does, would add additional safety to the use of aluminum for such a purpose. As sheets of aluminum can be used for car coverings, having less than one-third the thickness necessary for wood used under similar circumstances, the weight of the car, instead of being materially increased as with the steel cars, would be somewhat reduced from that of wooden covering now in general use; and here the freedom from serious corrosion from moist atmosphere, and from sulphur fumes, would be of special advantage.

In the semaphore signals, discs and their moving frame work, aluminum has already made an opening that bids fair to be largely increased, and we expect that the day is not far distant when the switch and signal companies will be among the large consumers of the metal.

Aluminum does not seriously corrode so as to interfere at all with the strength of thin sections of the metal as does iron or steel; the thin film of oxide which covers the surfaces of the metal which have been long exposed to moist atmosphere seems to prevent its being further acted upon. But it does give a surface tarnish to the metal which cannot be rubbed off with the usual metal polishing compounds without interfering with the surface of the soft metal. This can be removed by rubbing with a flannel rag which has been immersed in a two per cent. solution of hydrofluoric acid and then again rubbing up the polish with a carbon saturated with carbon oil.

When properly cared for, polished surfaces can thus be kept bright for a remarkably long time; but, owing to lack of knowledge of the way to keep the surfaces of the metal brightly polished, attempts that have been made so far to use aluminum for the reflector sheets of locomotive headlights have proved failures. But with the better knowledge that we have to-day of the easy possibility of retaining the surface polish of the metal, the subject we expect to have taken up again, with, we hope, better results.

For badges and buttons aluminum has already achieved a position, and I presume it is likely that many of the uniformed officials of the railroads represented by you gentlemen have aluminum coat-buttons and, perhaps, hat badges.

Art work in metals has already reached a high state of development in the interior decorations of passenger coaches of the better grade. Owing to its extreme malleability and easy casting qualities, aluminum is doubly destined to play a very conspicuous part in such work, as the metal is certainly susceptible of being worked up and finished in very beautiful and ornamental designs with changes in color and lustre, due to different ways of treating, that certainly will give pleasing effects. In the hardware of the interior of cars, as well as in most other grades of builders' hardware, aluminum bids fair certainly to have large use.

Much has been said of the prospects of aluminum to replace structural iron and steel. I have, however, very little hopes of the use of the metal for this purpose. At least the present knowledge which we have of the metal would not indicate a very great future for it in this direction, except, perhaps, in long cables. Aluminum wire can be readily drawn with a tensile strength of from 60,000 to 70,000 lbs. per sq. in., and with a reduction area of 50 per cent. This metal will have about one-third the weight of a similar strand of steel wire, and for some purposes such cables may be useful. But more probably it will be a hardened alloy of aluminum, which will be found to be ductile enough to be drawn readily into wire, which can be used most advantageously for such a purpose.

There is a prospect that some aluminum alloy with a specific gravity of not more than 3 to 3½ and with a tensile strength of 100,000 to 120,000 lbs. per sq. in. can be obtained; but I cannot point to such an alloy having been successfully made which would draw into wire as yet. Certainly for such a purpose as bridge members I feel confident that aluminum will never be used, for it has not sufficient strength or hardness to compete with steel.

In this connection of hardness, although entirely irrelevant to the subject, I would call your attention to the advisability of the use of manganese steel for bridge pins, members which rarely break but deteriorate by wear. I have lately seen results of the use of Hadfield's hard manganese steel, a photograph of which I send you with this paper, as compared with the ordinary Bessemer steel, forged. The disadvantage of the metal so far has been that this hardened manganese steel is very difficult to tool; but as it will be possible to cast a thread at the ends of the pins, which can be ground to an accurate fit with nuts, I believe this material is a very valuable one for bridge pins.

Probably the largest use of aluminum in railroad work will be as an alloy with other metals. Aluminum in proportions of a few per cent. added to very many different metals gives valuable properties. Among these alloys is, of course, aluminum bronze. The alloys of from 2½ per cent. to 12 per cent. aluminum with copper have so far achieved the greatest reputation. With the use of 8 per cent. to 12 per cent. aluminum in copper, we obtain one of the most dense, finest grained, and strongest metals known, having remarkable ductility as compared with its tensile strength. A ten per cent. aluminum bronze can readily and uniformly be made in forged bars with 100,000 lbs. tensile strength, 60,000 lbs. elastic limit, and with at least ten per cent. elongation in 8 in. An aluminum bronze can be made to fill a specification of even 130,000 lbs. tensile strength and 5 per cent. elongation in 8 in. Such bronzes have a specific gravity of about 7½, and are of a light yellow color. For cylinders to withstand high pressures, such bronze is probably the best metal yet known.

The 5 to 7 per cent. aluminum bronzes have a specific gravity of 8.30 to 8, and are of a handsome yellow color, with a tensile strength of from 70,000 to 80,000 lbs. per square inch, and an elastic limit of 40,000 lbs. per sq. in. It will probably be bronzes of this latter character that will be most used; and the fact that such bronzes can be rolled and hammered at a red heat with

* By Mr. Alfred E. Hunt, President Pittsburgh Reduction Works. Read before the New York Railroad Club, March 10, 1891.

proper precautions will add greatly to their use. Metal of this character can be worked in almost every way that steel can, and has for its advantages its greater strength and ductility and greater power to withstand corrosion, besides its fine color. With the price of aluminum reduced only a very little from the present rates, there is a strong probability of aluminum bronze replacing brass very largely.

A small percentage of aluminum added to babbitt metal gives very superior results over the ordinary babbitt metal. It has been found that the influence of the aluminum upon the ordinary tin-antimony-copper babbitt is to very considerably increase the durability and wearing properties of the alloy. Under compressive strain, aluminum-babbitt shows to be a little softer than the ordinary babbitt. A sample $1\frac{1}{2}$ in. diameter by $1\frac{1}{2}$ in. high began to lose shape at a pressure of 12,000 lbs. A similar sample of the same babbitt metal, without the addition of the aluminum (having a composition of 7.3 per cent. antimony, 3.7 per cent. copper and 89 per cent. tin), did not begin to lose its shape until a compressive strain of 16,000 lbs. had been applied. Both samples have stood about an equal strain of 35,000 lbs. In comparative tests of the ordinary babbitt metal and the aluminum-babbitt metal the latter has given very satisfactory results. At the works of A. W. Cadman & Co., 63 Water street, Pittsburgh, a crank pin bearing of a 30 H. P. engine, with the ordinary babbitt metal, required attention about every three days; and after inserting in the bearing aluminum babbitt strips of about $\frac{1}{2}$ in. width upon the face, dovetailed in alternately in the brass bearing, the same bearing ran under similar work for two months without requiring any attention; and when examined at the end of the two months, the crank pin was found to have become very much smoother than it was before the aluminum babbitt had been inserted. Mr. Cadman recommends dovetailing in strips of babbitt, for the reason that it gives equal bearing all over the surface. Another advantage of this babbitt is its extreme malleability. It can be hammered out to a thin edge without cracking, whereas the ordinary babbitt is not at all malleable. An advantage of this is that for bearings, with aluminum, the babbitt can be rolled into shape for inserting in the dovetailed recesses, and the recesses can be cast and drifted out at a very small expense and without waste of babbitt.

The influence of aluminum in the manufacture of wrought iron castings is demonstrated in the well-known Mitis process. These wrought iron castings seem to have all the ductility and strength of wrought iron, with the advantage of the aluminum making the metal fluid so that it can be cast into shape as readily as in cast iron. The difficulty has been so far to obtain uniformly sound castings; but this has now been overcome, and there are several concerns manufacturing Mitis castings successfully.

Aluminum is also being used very successfully in steel castings, and has added very considerably to the progress which has been made within the last two years in obtaining sound steel castings. A large number of steel casting companies are regularly using the metal aluminum in quantities of several pounds of aluminum to the ton of steel. In the manufacture of ordinary steel ingots by the open-hearth or Bessemer processes, it has lately been found that the use of aluminum in small proportions (from $\frac{1}{8}$ to $\frac{3}{4}$ of a pound of aluminum to the ton of steel) has proved to be an economical success, preventing blowholes and unsound tops of ingots. It has been experimentally proved that the addition of aluminum to the steel just before "teeming" causes the metal to lie quiet and give off no appreciable quantity of gases. There are two theories to account for this. One, that the aluminum decomposes these gases and absorbs the oxygen contained in them. The other is that aluminum greatly increases the solubility in the steel of the gases, which are usually given off at the moment of setting, thus forming blowholes and bubbles. This latter theory is the one which at present has the greatest weight of authority. In all cases the aluminum should be thrown into the ladle just after a small quantity of steel has already entered it.

There is danger of adding too large a quantity of aluminum, in that the metal will set very solid and will be liable to form deep "pipes" in the ingots. Just the right proportion of aluminum to add requires some little experience on the part of the steel manufacturer; but successful results have so far been secured with the amount of aluminum before mentioned—from one-third to three-quarters of a pound to the ton of steel. We have ourselves seen ingots filled within two inches of the top of the mold and allowed to cool without sand or stopper, and the surface of the ingot when cold was nearly as flat as if it had been sawed off.

With the use of our No. 2 metal, for adding to iron and steel, which the Pittsburgh Reduction Company sells at the rate of 90 cents per pound, the advantage it gives to the steel for the purpose mentioned above, decreasing the crop ends, will much more than pay for the extra cost of the steel. This may not, and will not, have much interest to the railroad men as a prospect of decreased price of the steel used in railroad work; but it will be of advantage in decreasing the danger of unsound steel being furnished, as is often the case now, by blooms being cut too near the crop ends.

There are many alloys of aluminum with other metals which promise good results. Some of these alloys are now being covered by letters patent. For this reason, as well as the fact that many of these alloys have not been sufficiently investigated to enable me to speak conclusively of them, I will say nothing at present. I can only prophesy that the field of the use of aluminum for improving the quality of other metals and alloys now in common use promises to be one of the most fruitful for investigation that is now offered in metallurgy.

Improved Automatic Square Chisel Mortiser and Borer.

This tool is especially designed for cutting mortises in hard or soft wood from $\frac{1}{2}$ in. to 9 in. deep. It will also make end tenons. The column is cast in one piece, cored out at the centre and braced to withstand strains and shocks. The bed-rests on the main column are held in position by gibbs. The cross movement is controlled by a friction clutch provided with stops to gauge the length of mortise. The upper part of the bed which holds the timber has an extra movement operated by a hand wheel and screw to gauge the depth of mortise. This is considered to be an improvement over a stationary bed where the depth of mortise is made by blocking up behind the timber that is being mortised.

The chisel mandrel is driven by friction and gearing,

with a quick return, and is raised and lowered by rack and pinion. There are suitable stops provided for gauging the travel of the slide, also a regulating screw for changing the position of the chisel to suit the work. The machine will take stock up to 16 in. wide and 14 in. deep, and cut a gain at the top of a 12-in. stick. An extra boring attachment can be fitted to the machine for boring joint bolt holes, side sills and general work. This machine is made by the Egan Company, Cincinnati, Ohio.

Railroad Legislation in North Carolina.

The state of North Carolina now has a railroad law which is as radical in many of its provisions granting power to the Commission as that of Iowa or Kansas; but it is by no means certain that the repressive action of the Western States will be taken by the North Carolina Commission as a pattern in carrying out the law. On the contrary, the Commissioners, though coming into office under Farmers' Alliance auspices, are men from whom judicious action may be expected, as will be seen by the following article sent us by President John

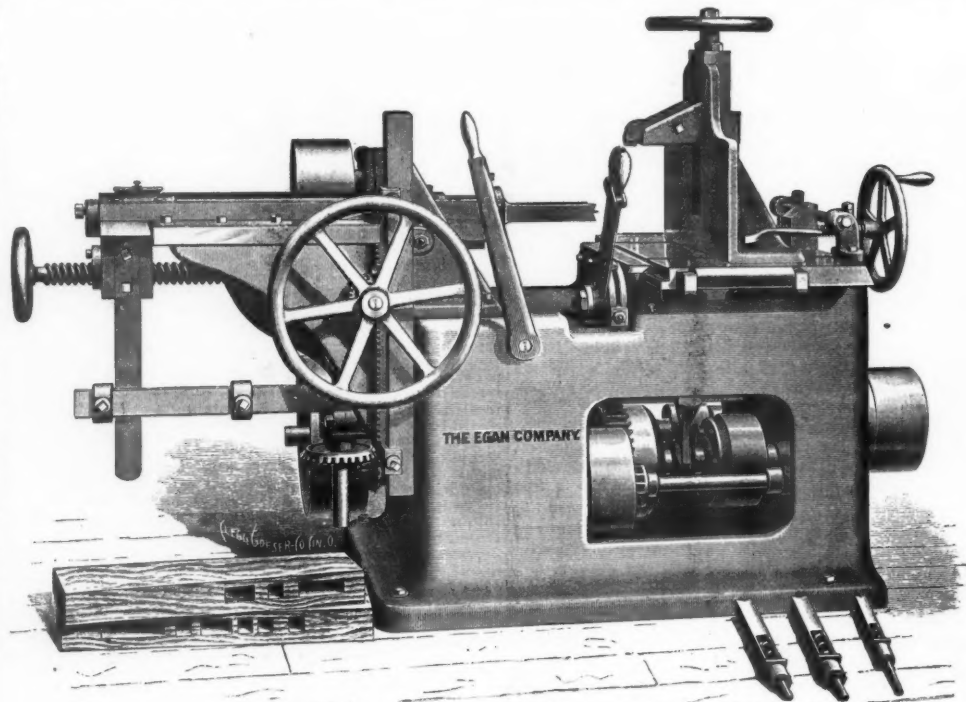
Requiring railroads to pay owners for injured or killed live stock within 30 days after receiving sworn statement of owner thereof. An appeal to commissioners from company's failure to pay shall render company liable for damages equal to three times the value of said stock, claim being subject to rebuttal by company.

The commissioners, three in number, elected by legislature, shall make reasonable and just rates of freight and passenger tariffs; in estimating which they may take into account actual value of capital employed, earnings, competition, etc. Shall also regulate terminal charges. Shall make necessary rules (just and reasonable) to prevent unjust discrimination among railroads. Commissioners' schedules of rates to be taken as *prima facie* evidence in court that said rates are just and reasonable. Appeals to the contrary being allowed by companies to the superior and thence to the supreme court.

The commissioners shall bring complaints, arising from discriminations on through freights on interstate roads, before the Interstate Commerce Commission.

They are authorized to subpoena witnesses under oath, witnesses to receive \$2 a day and 5 cents a mile for travel; to investigate books and papers of companies; to examine all officers under oath; to punish willful neglect (10 days' delay) in furnishing information by fine of from \$100 to \$5,000.

They shall order in writing whatever repairs on a railroad they may deem necessary, failure to comply with



AUTOMATIC, SQUARE CHISEL MORTISER.

Made by THE EGAN COMPANY, Cincinnati, O.

F. Crowell, of Trinity College, in that state. Dr. Crowell is a careful student of railroad economics as well as of public affairs generally. He says:

The recently closed session of the North Carolina legislature has been a remarkable one in the history of railroad legislation in that state. Always slow to adopt new machinery of government, her people wisely waited to learn from the experience of other states. In framing her railroad commission bill she follows closely that of her sister state, Georgia. The following abstract gives the essential features of the act. It is entitled

An act to provide for the general supervision of railroads, steamboat or canal companies, express and telegraph companies doing business in the state of North Carolina.

Making it extortion, punishable by a fine of from \$500 to \$5,000, for companies to charge more than a fair and reasonable rate of toll.

Making discrimination in rates unlawful, and punishable by a fine of from \$1,000 to \$5,000.

Making it unlawful to "receive any greater compensation in the aggregate . . . for a shorter than for a longer distance," except in special cases, by consent of commissioners.

Giving right of action for damages against companies within one year after wrong or injury to persons in violation of regulations made for companies by commissioners.

Requiring companies to issue duplicate freight receipts to shippers. Refusal on part of agent to deliver goods to consignee, upon presentation of said duplicate and payment of freight charges named therein, is punishable by fine of from \$50 to \$5,000.

Requiring all contracts and agreements between companies as to division of earnings to be submitted to commissioners for inspection and correction in conformity to rules and regulations prescribed by commissioners for the governing of pooling agreements. For violation of such rules and regulations the penalty is from \$50 to \$5,000, unless amended be made within 30 days from notice of violation.

Forbidding the abandoning or diminution of accommodations of freight or passenger stations of one year's standing, except by consent of commission, by whose order in writing stations may be relocated.

Requiring all common carriers to afford reasonable, proper and equal facilities for interchange of freight and passengers, without discriminating against connecting lines, according to trackage rules made by commissioners. Penalty, from \$500 to \$5,000.

Defining the term "companies" contained in Act to mean railroads, canals, telegraph lines, express companies and individuals or firms doing business as common carriers, whether incorporated or otherwise,

which makes railroad liable to penalty of from \$50 to \$2,000.

They shall have power at discretion to require separate and equal accommodations for white and colored passengers on trains and at stations. Penalty, \$50 to \$2,000.

They shall make an annual report to the Governor of the state, with recommendation of legislation deemed by them advisable.

Privileged classes of passengers and freight specified as not coming within scope of this act.

Expenses of commission not to exceed \$2,000. Salary of each of three commissioners to be \$2,000 a year. Clerk's salary, \$1,200. Act in effect, April 1, 1891. Fiscal year to end June 30.

Special acts were passed requiring railroads to redeem unused tickets, to prevent scalpers from dealing in tickets and to provide for emigrant and excursion tickets to be issued.

The other most important railroad legislation consisted in the renewal of the charter of the Petersburg Railroad, operated by the Wilmington & Weldon Company. After an effort to extort from the latter road its privilege of exemption from taxation by a threatened refusal to grant the renewal of the Petersburg charter, this charter was renewed for two years only and an act passed to prevent any paralleling toward the Virginia line from the line of the W. & W. Company northward.

The Raleigh & Gaston Division of the Seaboard Air Line enjoys a similar exemption from taxation. To force the surrender of this privilege a bill was introduced to repeal the charter of the Georgia, Carolina & Northern, which is the southern link to Atlanta of the S. A. Line. This bill failed, but shows the temper of the legislature toward the privileged lines.

The Atlantic & North Carolina had its charter amended to provide for the extension of the road westward to some point on the Cape Fear & Yadkin Valley system. Besides this there were no less than twenty-six new charters granted, not including nine charters for short lines here and there in the state. The effect of the new railroad commission law has not apparently lessened the demand for charters; in spite of fears to the contrary, based on legislative restrictions, the state hopes to stand among the first in the Union in her increase in mileage this year.

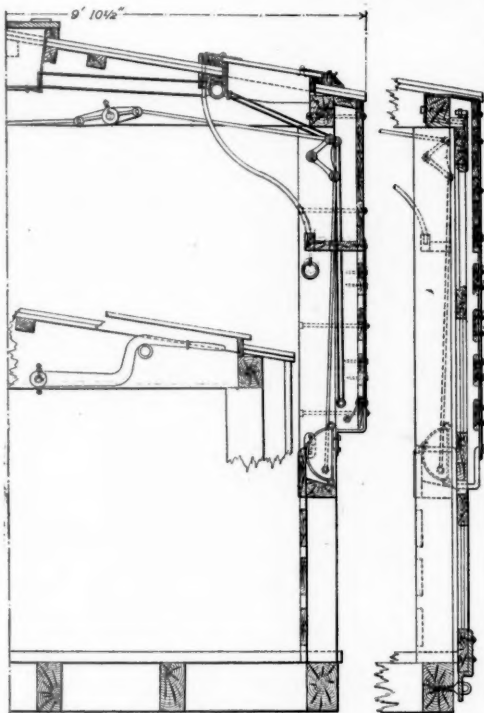
The personnel of the Commission is interesting and assuring. James W. Wilson is a civil engineer, who won fame as the pioneer in the construction of the

Western North Carolina road through the mountains to Asheville; Thomas W. Mason is a clever and brilliant lawyer of Weldon, and E. C. Beddingfield is a popular and talented Farmers' Alliance lecturer. Geographically, the selection is well distributed, taking into account the multitude of candidates. It is a good Commission, conservative and safe, and the men were selected strictly as the Act implies with regard to their general ability to stand between the public and the railroads in the critical business of making rates for the administration of an extensive system of trunk lines of railroads. Their main office will be at Raleigh. The clerk has not yet been appointed. Mr. D. B. Nicholson, of Clinton, is strongly urged for the position.

The Burton Horse Car.

The engraving which is given herewith shows in three different sections some of the details of the Burton Stock Car Company's latest car for the transportation of horses and mules. On the 10th of March the company informed us that 125 of these cars were in use, and that they were being built at the rate of about two a day.

The animals are loaded loose in the car, standing crosswise of it, and each car will carry about 20 head.



Burton Horse Car.

Hay for a journey of about 2,000 miles is carried in the iron racks. Water is taken from the ordinary engine cranes into the trough under the running plank, which is shown in half section in the engraving. Thence it flows, through the pipes which appear, to the troughs which run on either side of the car. These troughs are tipped by a lever, the operation of which will be perfectly apparent from the illustration. One movement of the lever, which is placed in about the middle of the car, turns the troughs on both sides of the car into the position to receive the water. The reverse motion of the lever upsets the troughs and empties the water to the ground outside the cars.

These cars are 36 ft. long, equipped with Westinghouse automatic air brake, Hinson couplers and swing-beam trucks.

An Air-Brake Instruction Train.

What follows is the substance of a letter from Mr. E. B. Wall, Superintendent of Motive Power Pennsylvania Lines west of Pittsburgh, Southwest System. Mr. Wall wrote in answer to a letter from this office asking for definite information concerning the train.

We put this train on last summer and ran it from Aug. 16 to Nov. 1. The purpose of the train was not for examination, but to afford instruction to all employees, any of whose duties were involved in the operation or maintenance of the air brake. The train consisted of 20 empty 60,000 lbs. capacity stock cars, equipped with the Westinghouse quick-acting automatic brake; also one coach on the rear end, equipped with the old style automatic brake. The locomotive hauling the train was equipped with both the old style and improved engineer's brake valve, together with all of the latest improved details of the Westinghouse air brake. The locomotive was what is known as our class "O," having four coupled drivers 62 in. in diameter, four truck wheels 33 in. in diameter, cylinders 18 in. x 24 in., boiler pressure 160 lbs., weight of locomotive in working order 90,672 lbs. The stock car next to the coach was equipped with gauges, so located that the pressure in the train pipe, auxiliary reservoir and brake cylinder could be observed during all the operations. In the coach a supply of instruction books, illustrated catalogues, etc., was carried for dis-

tribution. Sectional models of the various parts of the brake were also provided for special instruction.

The train was in charge of Mr. S. P. Bush, Assistant Engineer of the motive power department. He was assisted by a locomotive engineer selected from one of the divisions, who was thoroughly familiar with the air brake in all its details. This train was run over all the divisions of the Southwest System of the Pennsylvania Lines West of Pittsburgh.

When the train started on each of the different divisions a regular train and engine crew, known to be well versed in the air brake, was selected. This crew not only operated the train, but also assisted in giving instructions. The employees instructed were the enginemen, firemen, conductors, brakemen, switchmen, air brake inspectors and air brake repairmen. At convenient hours in the morning and afternoon the train would start from a terminal, taking with it as many of the men as could be spared at the time, and would go to some quiet, convenient place, nine or ten miles distant, where the instructions would be given. The classes would average in number from 18 to 20. They would first be assembled at the side of the rear stock car to which the gauges were attached and there a general explanation of the air brake would be given by either the representative of the Motive Power Department or the special locomotive engineer first mentioned. This explanation would cover the straight air brake, the old automatic and the new quick-acting brake, and the various operations of application and release would be gone through with. The engineers had an opportunity to observe exactly what took place when a certain reduction of train-pipe pressure was made on the engine, and they were instructed in what the successful manipulation consisted. The pressure-retaining valve would be explained and its operation shown, and the effect of improper care and handling fully explained to all, so that, in a general way, the enginemen would know the duties of the trainmen and the trainmen the duties of the enginemen. Such points as the application of the brakes from the train by use of the conductor's valve, or otherwise, coupling, uncoupling, testing, etc., were included.

After this explanation, the enginemen were sent forward to the engine, where they were instructed by the division engineer upon the operation of the improved engineer's brake valve, upon the various cases that are liable to arise in every-day practice, such as the regulation of the brake on the second engine, where double-headers are run, and the effect of leaks in the train pipe, small auxiliary drum or connections. The trainmen were retained at the rear of the train and instructed on such points as particularly concerned them, such as testing the proper condition of brakes on cars, taking up slack, coupling, uncoupling, etc. All parties were given an opportunity to ask any questions they desired, and to make any reasonable experiments.

The train was then started on the home trip, making, on the way, a series of experiments, for the purpose of demonstrating what it was possible to do with the brake, and the effect in various cases. These experiments were as follows:

1. The service stop, with all of the brakes in operation, for the purpose of demonstrating how smoothly the train could be handled.
2. The emergency stop, with all of the brakes in operation, for the purpose of demonstrating how quickly the train could be stopped.
3. A break-in-two at any point the men might suggest, to demonstrate how far the front section would separate from the rear section, brakes connected on the entire train.
4. All of the brakes cut out, except six or seven next to the engine, and a break-in-two at any point between the engine and the last car that the brake operated. This experiment was made for the purpose of showing what might take place when only a few air-brake cars in a train are in use, and to show, as in all of the experiments, the duties of the men in each case.
5. All of the air brakes cut out, except six or seven next to the locomotive, and the emergency application made, taking up all of the slack in the train. This was done to show the effect of bad handling. In this case every one, including the locomotive enginemen, were placed at the rear of the train, where the severity of the shock would be felt.
6. Train in same condition and a service stop made, to demonstrate that with a few air-brake cars next to the engine the train can be smoothly handled.

In the experiments where the train was broken in two an arrangement was provided by which it could be separated at any time without the knowledge of the engine crew, thus making the cases the same as those in actual practice and under the worst possible conditions. When the experiments were finished, the train was returned to the terminal, ready to take out a second class in the afternoon.

The men were pleased with the performance of the train and seemed to take a great deal of pleasure in receiving instructions, many of them accompanying the train several times. Much interest and discussion were created, and the general fund of knowledge on the air brake increased. Our object was to give every one concerned in the operation and maintenance of the air brake thorough instructions, and an opportunity to observe the operation under conditions that prevail in regular

service. We considered that we could reach the men better by the train than by the use of a single car, fitted up with a mass of apparatus. Cars like the latter undoubtedly serve a very good purpose, and we shall probably run one of them later on. We have never made any attempt, and I do not feel inclined to recommend that we should, to instruct the trainmen, especially freight trainmen, in the detail mechanism of the air brake. We simply want them to know what the air brake does and what their duties are in connection with it. If they desire to know how the air brake does it, we will afford them every opportunity to learn; but our examination is only made to cover the former points. We propose to furnish at all terminals not yet provided, regular working models of the air-brake apparatus, where new men hired will receive instruction, and where the old men, before they are promoted, will be examined. You will understand that we do not propose to run this train every year. It was only run as one of the preliminary means of affording general instruction.

We are using the air brake on our freight trains whenever it is possible, always shifting the cars with air brakes to the front of the train. We are averaging now about seven air brake cars to the train. As the air brake is being introduced rapidly on other cars, it will not be long before the majority of the cars in a train are air braked. We may find, later on, that it would be well to run the train another season; if so, we shall, of course, do it, regularly carrying on all the time our instructions and examinations by means of the models at terminals.

High-Pressure Electric Power Transmission.

In the line of electric power transmission, the projected installation to supply power to the city of Frankfurt-on-the-Main, in Germany, from the town of Lauffen, has of late attracted considerable attention, mainly because of the high voltage to be carried, which, according to various German accounts, is to be in the neighborhood of 25,000 volts.

The town of Lauffen lies on the River Neckar, 175 kilometers distant from Frankfurt, and has an available water-power of about 300 horse power. This power is to be used for driving three primary dynamos of 120 horse power each, one of them to be held in reserve for emergencies. The electric current is to be transmitted through copper wires 4 millimetres (0.16 in.) in diameter, carried 10 meters (32.8 ft.) above the surface of the ground on poles placed about 100 meters (328 ft.) apart. The Oerlikon Machine Works, in conjunction with the General Electric Company, of Berlin, are to furnish the necessary machinery and assume the cost of operation, while the committee of the forthcoming international electric exhibition at Frankfurt is to bear the cost of the transmitting line.

The remarkably high voltage is to be employed so as to enable the use of the comparatively small diameter of transmitting wire and thus reduce the cost of the installation. Transformers will accordingly be used, so that a 50-volt current, for example, can be converted into one of, say, 15,000 volts, which, at the other end of the line, will again be reconverted into the original one of 50 volts, which latter will be used for lighting and power purposes.

In order to show, in a practical way, that transformers can be made and used for such high voltages, and at the same time secure reasonable safety and satisfactory commercial efficiency, and to demonstrate also that such high-tension currents can be transmitted over long distances, the Oerlikon Machine Works have arranged an experimental plant which has been in operation since the early part of last November, and which represents a length of line of about 10 kilometres (6.21 miles). The plant has been in operation almost daily in all kinds of weather, working with voltages as high as 40,000 volts, and is said to have performed in an entirely satisfactory manner, without giving rise to any unusual difficulties. Only the ordinary methods of insulation have been adopted in this line. The results, according to the *Schweizerische Bauzeitung*, have shown conclusively that the projected Lauffen-Frankfurt installation is entirely practicable, and the hope is expressed that the undertaking will receive the support necessary to insure its realization.

The Smoke Problem in Germany.

One of the latest results of the agitation commenced in Europe several years ago to suppress, or at least moderate, the smoke problem, is the offer of two prizes by the Society of German Engineers for essays on the subject. An appropriation of 8,000 marks (about \$2,000) has been made for the purpose. One of the prizes is offered for the best essay on smoke-preventing devices applied to steam-boiler furnaces, the competition closing on Dec. 31, 1892. The other prize is to be awarded to the best essay on similar devices applicable to domestic use, and to industrial uses where steam boilers do not enter. The date of closing of this competition is given as Dec. 31, 1894. Each of the essays is to embrace a brief review of what has been done in the past in these lines, and a comprehensive discussion of smoke-preventing devices of the present time entering the subject in detail. Special importance will be attached to careful records of the results of earlier experience, and to reviews of results secured by smoke ordinances in various countries and cities. Successful smoke-preventing appliances are to be illustrated, in as good a manner as possible, by drawings. The prizes have been fixed at 3,000 marks each (about \$750), but an additional sum, not to exceed 1,000 marks (\$250), is to be allowed for the drawings. The competition is open to all, without regard to nationality, though it is but fair to presume that essays in the German language will receive preference.

Plumbago Facings for Foundry Moulds.

The Dixon Crucible Company says that actual sales of plumbago show that barrels of plumbago are now used in foundries where pounds were formerly called for. The use of a plumbago facing guarantees to the casting a smooth surface and bright color. Caution is suggested when purchasing to obtain exactly the kind wanted for the work. One kind of plumbago is better applied by the shake-bag, and if the brush is used another kind will prove better. One preparation of plumbago will "stick," another will not. Another kind is more useful for light castings, another kind for heavier work. A wash of plumbago for cores, loam work and dry sand castings is indispensable.



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EDITORIAL ANNOUNCEMENTS.

Contributions.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to ALL DEPARTMENTS of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.

Advertisements.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. We give in our editorial columns OUR OWN opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.

Since the discussion the last two years of the subject of locomotive counterbalancing,* in which it has been shown that by far the largest field for improvement is in the reduction of the total weight of the reciprocating parts, there has been a decided advance in the matter of lighter driving gear for locomotives. Main rods and crossheads have been reduced in some quarters, but pistons have received the most attention. To-day the Baldwin Locomotive Works are making wrought iron, forged pistons of reduced weight, and cast steel single plate pistons are in favor in many places; the most prominent example being the new Chicago, Burlington & Quincy compound, which has cast-steel, single plate pistons, the largest of which, 28 in. in diameter, weighs less than the ordinary 19 in. of cast iron. Pressed steel pistons are under-way, and we are promised some of that material before many months. One road is now contemplating making its own pistons and rods in one piece, of forged wrought iron. This is all in the right direction, but it may be reasonably doubted if much progress will be made with pistons and rods all in one piece, as a reliable weld in a piston rod would be difficult to make, and to draw the rod out of a block sufficiently large to form a piston head would be expensive. It is but natural that this question of lighter reciprocating parts should be first generally agitated here, as here are found the heaviest express engines, and consequently the heaviest parts to be balanced. The decrease in that portion of the counterweight which now injures track and bridges at high speeds, by the use of lighter pistons may be at least 50 per cent, when the original strength is preserved. With the same attention paid to the reduction of weight of the crosshead and main rods as is now being given to piston heads, we should soon cease to hear complaints of the injurious effect on permanent way of excessive or badly disposed counterbalances.

The New York Railroad Commissioners have made a preliminary report on the Fourth Avenue Tunnel collision of Feb. 20, and the summary of it, as printed in the press dispatches, will be found in another column. We judge from the language used that the torpedo attachment, which was taken off when the gong was put in, has been again put in use. In general, the recommendations of the Commissioners are sound. In recommending ventilation they confine themselves to the side tunnels, which is doubtless the best course. The main tunnel is not susceptible of improvement by chimneys or fans, except for two short stretches. But in advising a reduction of speed to 15 miles an hour (until audible signals are perfected) the Commissioners are unreasonably cautious. Probably two-thirds, possibly four-fifths, of the trains going through the tunnel find a comparatively free atmosphere, and the engineman

can see the signals 1,000 ft. before he reaches them; under these conditions the proper rule for speed is that enunciated by one of the runners before the jury—"Get there as soon as you can." When Mr. Depew so eloquently interviewed himself about the inevitable ultimate dependence upon the fallible human intellect for safety, he forgot to mention several important safeguards that might be used (but are not) before running up against that final barrier; but where we must depend upon visual signals which are sometimes very obscure and sometimes very easily seen, we have not only the most appropriate field for the human agency, but one in which it is the only available resource. If we cannot depend upon the engineman to decide when to run fast and when to run slowly, what can we depend upon him for?

One-Shoe or Two-Shoe Brakes.

A great deal has been said at different times concerning the relative efficiency of locomotive driver brakes of the one-shoe and two-shoe types. The most remarkable contribution to the discussion that has been made lately was a communication from Mr. James Howard, which was published in the *Railroad Gazette* March 13, which is based upon the very astonishing theory that journal friction tends to stop the rotation of the wheel but does not retard the motion of the vehicle. We shall offer no theories, but merely present some familiar facts and known laws.

It would seem to be safe to start with the assumption that any resistance whatever to the free motion of a moving body has a retarding effect upon its motion. Any resistance to the motion of the body must be applied from the outside, generally through contact with some other body, as no internal forces can of themselves affect its motion any more than a person can propel the boat he is in by blowing upon the sails, or may lift himself by his boot-straps. The locomotive is in contact with two external agents, i. e., the atmosphere and the rails, and, the former being neglected, it is only through the resistance which the rails may be made to offer that the motion of the engine can be stopped.

A certain amount of friction can be developed between the rail and wheel and utilized as a retarding force. Any tendency to stop the rotation of the wheel develops this retarding action of the rail upon the engine. It is well known that the rolling of the wheel upon the rail tends to stop the rotation, and this tendency is called rolling friction. The friction of the bearings upon the journals tends to stop the rotation of the wheel and develops the resistance known as journal friction. The friction of the reciprocating parts and other machinery of the engines tends to stop the rotation of the wheels and adds a further resistance to the motion of the engine. Every one knows that these resistances combined will alone stop the engine in time; and the greater the sum of these resistances the quicker it will stop. In applying a brake to the wheel or the axle, an additional resistance is produced and the engine is stopped quicker still.

To reduce the matter to more exact relations: The greatest resistance which may be utilized in stopping the motion of the engine is the maximum friction which can be developed between the rail and the wheel. This friction multiplied by the radius of the wheel may be called the moment of rotating friction, and is the measure of the tendency of the wheel to rotate. The friction of the journal multiplied by the radius of the journal is the moment of journal friction and measures its tendency to stop the rotation of the wheel and its retarding effect upon the motion of the engine. The friction of the brake shoe multiplied by the radius of the wheel is the moment of brake-shoe friction and measures its retarding effect in the same way. The ratio of the sum of these retarding moments to the rotating moment is the measure of efficiency in stopping, up to the point where the sum of the retarding moments equals the rotating moment. The number of these retarding moments is of no significance, so long as the sum remains the same, and, so far as efficiency is concerned, one large brake shoe friction moment is as good as 20 small ones.

If, therefore, the sum of these retarding moments be the same upon a consolidation engine, with one shoe upon one wheel, as upon the same engine with two shoes applied to each wheel, the engine would stop in the same distance and time in both cases. It is well known that sufficient resistance may be brought by the one shoe upon one wheel to overcome the rotating friction of the eight wheels and to slide them; or, in other words, all the frictional resistance to the motion of the engine, which the rails can possibly produce may be developed by the one shoe, and it thus develops the highest efficiency attainable, as the brake friction necessary to the highest efficiency is

attained before the point of sliding the wheels is reached.

In practice only a moderate proportion of this greatest efficiency is attempted, as the liability to slide the wheels when the rail is bad, limits the practicable driver-brake efficiency. Mr. Howard assumes that he can use a greater resistance to the rotation of the wheels than long experience indicates to be desirable. Hence he is in greater danger of sliding the wheels.

No comparative test has ever been made of the two systems, where the same braking force was used upon both; but it is certain that a given amount of retarding force would produce the same effect with either system. That the same braking force may be applied through both systems cannot be questioned, and, it having been decided by the railroads how far they are willing to risk skidding the driving wheels, the question of relative efficiency is reduced to an absurdity.

It is not asserted that a given pressure will develop the same friction between brake shoe and wheel as between wheel and rail or between the lubricated surfaces of bearing and journal. The area and character of the surfaces in contact bring into the general question of the desirability of two shoes altogether different elements, and very considerable advantages may be realized from the use of the two-shoe brake under some conditions. It is known that under very heavy pressures per square inch the coefficient of friction and the abrasion of the metal do not follow the same laws as at lower pressure. If the pressure per square inch be reduced, the wear per square inch is reduced more than proportionally, and the desirability of larger shoe area to reduce the pressure per square inch is apparent. If, in applying two shoes, the shoe area is doubled, less than one-half the pressure per square inch may be applied to produce the same retarding force, as the coefficient of friction increases, and very much less than half the wear of shoes per square inch area is the result. This fact has proved sufficiently advantageous to induce several roads to apply the two-shoe brake to the wheels of their passenger cars, where the additional advantage is gained of preventing the trucks tipping on the equalizer springs and causing jolts when the brake is applied. The additional mechanism, upon passenger trucks, is much less cumbersome than would be supposed and seems to be fully warranted by the results. The advantages are: The mileage of the car is much greater between the necessary adjustments of brake-shoe slack; the replacement of the shoes is less frequent, as two shoes will wear more than twice as long as one, and the cost of maintaining brake shoes is reduced. In applying the same principle to locomotive driver brakes the advantages of large brake-shoe areas may be more than offset by the increased number and complication of parts.

The Standard Car Coupler.

The annual movement to get the Master Car Builders' Association to change its mind about freight car couplers shows signs of life. This has come to be one of the signs of spring, and may be looked for about the time the robins begin to sing in the country around New York and grass begins to look green in the country lanes which traverse the 185 square miles of Chicago. Two years ago it appeared in the form of letters to the papers; but the editors received them coldly, and the movement aborted, like the premature peach buds. This year the effort is more subtle and carefully guarded, and it may live till convention time; but we doubt it. Its precise form is not yet revealed; probably it has no precise form. It is not at all likely that the Master Car Builders' Association will this year or next, or in ten years, abandon as a standard the type of coupler which has taken the name of the Association. But it may be well to consider some of the reasons for and against such action, and to examine briefly the ground that those who say the M. C. B. coupler is a failure can stand on.

Probably the consideration that will have the greatest weight against it is the cost of maintenance. This has been much discussed, but it has not yet been proved that the cost is greater than, or as great as, the cost of maintaining link-and-pin couplers, either automatic or non-automatic. The cost due to breakages is generally overrated; that due to wear is generally underrated; but, taking both elements together, the total is probably not very far from the maintenance cost of link-and-pin couplers. However this may be, so long as the coupler men will maintain the vertical plane coupler for one dollar a car a year this consideration loses most of its weight; for there is probably no road on which the link-and-pin coupler can be kept up for that sum.

The high first cost of the M. C. B. coupler is another argument that is brought against it. Competition will

* A full discussion of locomotive counterbalancing and the advantages of light pistons and other reciprocating parts was given in the *Railroad Gazette* Jan. 25, April 12, Sept. 6, Oct. 11 and Dec. 20, 1889; also, a recapitulation of the data appeared in the *Railroad Gazette* March 21 and April 4, 1890.

reduce this cost to the lowest limit at which a manufacturer's profit can be made. Probably the present price is not too great for a coupler of competent design, material and workmanship to do what the automatic close coupler must do to live. It must not be forgotten that to make an automatic coupler that will couple closely, will couple and uncouple freely, will not uncouple from wear, distortion, or jumping of the lock, and will wear well, is one of the hardest mechanical problems in railroading, and it is doubtful if it can be accomplished for less money than is now paid for the M. C. B. coupler.

There is a class of difficulties developed in service which is inherent in the present type of vertical plane coupler, and doubtless in any practicable form of close coupling; that is, the increased resistance in passing curves, and the distance between the positions of the axes of the couplers when they are on cars of different lengths and on sharp curves. This is a mechanical detail to be corrected by experience, and, as we have said, it is common to any close coupling. In itself it is no reason for giving up the type. In practice it is now found to be an objection only on roads with sharp curves and in yards, and many deny that it amounts to an objection even there.

One of the troubles of the transition period is the difficulty of knowing when the coupler is worn or bent to that degree that introduces danger of uncoupling. This also is a passing trouble which will be eliminated with experience. The same thing is true of the trouble that some roads have had from getting couplers made of weak material. Buyers will simply have to test and inspect vertical plane couplers as they do other material purchased.

It is said that the coupler is not automatic in that it cannot be opened to couple without going between the cars. That is not true now of some specimens of the type, and not necessarily true of any. It is said that the dangers of coupling are actually increased when vertical plane and link-and-pin couplers come together. That is a passing evil.

There is the danger that an M. C. B. drawhead, pulled out of the draft rigging, may drop on the track and cause a wreck. This must be guarded against by correct construction; it ought not to be ignored.

These are all the serious arguments that can be brought against the M. C. B. coupler by those who may try this year to get the Association to reconsider its action in making it standard. Not one of them involves a demonstrated and lasting objection to the type. On the other hand, what would be the result of abandoning the present standard?

It would leave the country without a standard coupler and with none in sight. There would be no chance of getting another one adopted for years. The situation would be even more chaotic than it was when the Association first took up the subject. Agreement upon a uniform type or make would be indefinitely postponed, while the railroad companies would find themselves face to face with actual or threatened legislation compelling them to use automatic couplers. State legislatures and Congress have refrained from such legislation largely because they have believed that the railroads were trying seriously and wisely and conscientiously to work out the problems involved. If they see the effort deliberately abandoned now, for no apparent and adequate reason, how much longer will they keep their hands off?

But, as we intimated at the outset, we suspect that we are fighting a man of straw. The M. C. B. coupler was recommended by the General Time Convention at its last meeting by a vote of 48 to 2. It has been adopted as a standard for new construction by roads owning a large percentage of the track and equipment of the country—25 per cent., at least, we should suppose. Those opposed to this solid and definite interest are united on nothing, and have nothing to suggest but an abandonment of the present standard. Therefore there does not seem to be any imminent danger that the Association will reverse its well-considered and deliberate action.

Abolishing Unlimited Tickets.

The proposition to put a time limit on all tickets, both local and through, which in a sense is simply a plan to prevent passengers stopping over (and using their tickets for speculation), either at way stations or at terminals of roads, is also important in minor features, and may have important good effects, even if it does not prove to be universally feasible. The benefits to be secured through these secondary advantages must be the main thing in the minds of the traffic men who are acting in the matter; for as regards shutting out the scalpers, the existing practice is in most

cases all right in theory and no improvement is needed except in the application of the theory. In point of fact, unlimited joint rates are very little used, and most of the defiant scalping, whether by circuitous routes or otherwise, is done on tickets which are limited, but are not limited closely enough to the actual train time. What is needed is a general agreement to limit to actual traveling time. Scalping done on unlimited tickets is pretty sure to be found on investigation to have been done by permission of the road. As an agreement of this kind will be just as hard and just as easy to maintain as other agreements looking to maintenance of rates, the immediate results are not likely to be startling.

But the reform will be a good thing, even if it do no more than simplify the rate sheets. The idea that unlimited rates must be quoted, so that limiting conditions may be said to be imposed "in consideration" of a reduction in the price asked, is not regarded by the traffic or legal officers of the roads as of much account. It stands to reason that a road need not permit purchasers to hold tickets forever, and the ultimate question turns simply on the reasonableness of the conditions imposed. Tickets have from time immemorial been limited to 30 days, 60 days, etc., and in depriving passengers of the ancient privilege of treating a ticket as good until it is used the problem before the passenger agents is to provide regulations by which the public will not be inconvenienced. If a man has to ascend to the seventh floor of the general office, and sign triplicate vouchers in four colors, before he can get back his money for an unused ticket, he will naturally fight for his cherished "rights," no matter how much the technical points of the law may favor the railroad. Under present practice the redemption of a ticket often involves several days' if not weeks' delay, and the progressive managers will do well to see that their slower brethren are fully impressed with the necessity of a change in this respect; for passengers who are displeased on one road are very liable to feel sour toward all roads.

The benefits to be expected from a general tightening of the lines are to be looked for in the general good effect on all concerned and the improvement in clerical matters. Local tickets are now treated too much like money, and they are too handy for use as a long-time investment by various classes. When they become more "perishable," conductors who are inclined to hand them over to scalpers will have one resource cut off. When foreign roads cannot demand pay for coupons three months old, one annoyance incident to settlements will have been removed. The limiting of local tickets where large numbers are sold every day will probably have to be done by some other method than punching, or at least by the use of some new means in connection with that. Here is a chance for ticket sellers to exhibit their ingenuity, though the prospects of remuneration through the aid of the Patent Office are not particularly bright.

The Missouri Pacific Report for 1890.

This report furnishes a remarkably clear illustration of the effect of low rates on what would otherwise have been a very prosperous year's business.

The mileage covered is as follows:

	Miles.
Missouri Pacific and branches.....	3,145
St. Louis, Iron Mountain & Southern.....	1,208
Little Rock & Ft. Smith and Little Rock Junction.....	172
Kansas & Arkansas Valley.....	170
Central Branch Union Pacific.....	388
Sedalia, Warsaw & Southern.....	42
Total.....	5,125

Average mileage operated during the year 1890..... 5,109

The operating figures, which are the ones of special interest, are given for the whole system; the financial figures, not for the whole, but for the various parts separately. We have not space to do justice to the latter. The former are as follows:

	1890.	1889.	Increase or Decrease.
Freight.....	\$17,843,244	\$16,178,134	I. \$1,665,109
Passenger.....	5,090,647	4,545,650	I. 544,996
Mail.....	735,473	703,794	I. 31,678
Express.....	484,376	495,087	D. 10,710
Rent.....	51,873	47,471	I. 4,402
Miscellaneous.....	1,164,728	1,223,328	D. 58,600
Total.....	\$25,370,341	\$23,493,467	I. \$1,876,874
Earnings per mile of road.....	4,965	4,680	I. 284
Earnings per mile run by frt. and pass. engines.....	1.00059	1.22780	D. .12821

	1890.	1889.	Increase or Decrease.
Conducting transportation.....	\$6,787,596	\$5,785,575	I. \$1,002,021
Motive power.....	5,063,068	4,437,566	I. 625,502
Maintenance of way.....	3,990,960	3,489,250	I. 501,710
Maintenance of cars.....	1,575,310	1,275,833	I. 299,476
General expense.....	585,192	541,658	I. 43,534
Total.....	\$18,002,728	\$15,532,883	I. \$2,469,845
Per cent. of expenses.....	70.960	66.116	I. 4.844
Expenses per mile of road.....	3.523	3.091	I. 428
Expenses per mile run by frt. and pass. engines.....	.78026	.81177	D. .03151
Net earnings.....	\$7,367,615	\$7,960,553	D. \$592,938
Net earnings per mile of road.....	1,442	1,586	D. 144
Net earnings per mile run by frt. and pass. engines.....	.31993	.41693	D. .09697

The transportation figures are as follows:

	1890.	1889.
Tons of freight carried.....	7,465,823	6,813,391
Tons of freight carried one mile.....	1,742,129,301	1,428,576,397
Average distance one ton of freight carried.....	233.35 m.	209.67 m.
Revenue per ton.....	\$2.30	\$2.57
Revenue per ton per mile.....	.0102	.0113
Number of passengers carried.....	5,635,977	5,177,974
Number of passengers carried one mile.....	235,946,591	197,547,232
Average distance one passenger carried.....	49.87 m.	38.15 m.
Revenue per passenger.....	.9332	.9338
Revenue per passenger per mile.....	.0216	.0245

Here we have an increase in freight movement of 22 per cent. and in passenger movement of 20 per cent., but a fall of 10 per cent. in freight rates and of 12 per cent. in passenger rates. The increase in gross earnings was thus only 10 per cent. on freight and 5 per cent. on passengers. Meantime the operating expenses of all kinds had increased 14 per cent., and this was more than sufficient to swallow up the increased earnings.

For some reason, the increase of business was not accompanied by increased train loads, the figures for freight trains showing a fall from 161.7 tons in 1889, to 161.2 in 1890. In the loading of the cars there was a slight advance in economy, and in the figures of cost per train mile; but the great source of economy, the handling of traffic in larger masses, is conspicuously absent. This is the more remarkable since so large a part of the increased ton mileage was due to the movement of grain. It seems to indicate that the effect of legislation has been, as is so often said, to force railroads to develop their less economical traffic on the same basis as that which they can handle to greater advantage. The traffic has increased; the economy which accompanies the natural increase of traffic has not been secured.

We cannot better close than by a schedule of ton-mile rates for the past nine years:

	Cents.		Cents.
1882.....	1.63	1887.....	1.23
1883.....	1.57	1888.....	1.15
1884.....	1.46	1889.....	1.13
1885.....	1.38	1890.....	1.02
1886.....	1.28		

The New York Tribune, in a long article on the export beef trade, says that \$150,000 is being spent on improvements at the Jersey City abattoir at Harsimus Cove (Central Stock Yards & Transit Company), and that the business of slaughtering cattle here for export to Europe is steadily increasing. Last year a sudden fall in prices in England left exporters of live cattle with a lot of vessel charters on their hands which they could not use, and they suffered heavy losses; so that it is now believed that the export business will fall into the hands of American butchers. This leaves New York and Chicago the principal competitors; and the men who butcher on the Atlantic coast think they can keep ahead of Chicago, because they can deliver meats in better condition. The number of days required from the killing in Jersey City to the delivery at English retail butcher shops is claimed to be just right for the best results. Of the 600,000 quarters of beef exported from New York in 1890, 466,743 quarters were prepared in and near New York. The ocean steamers have been increasing their capacity for carrying dressed beef. The "Teutonic" can carry 2,800 quarters; the Guion vessels 2,200 to 3,300 each; the Cunarders, 4,200 to 4,700 each; the White Star liners, 2,800 quarters; the State Line ships, 1,100 to 1,600 each, and others, both regular and occasional, from 800 quarters upward. The meat is kept firm and hard, but not frozen, in boxes cooled by refrigerating machines, precisely as in storage houses. Every quarter is shipped in a muslin cover, after being weighed, and stamped on the outside of the muslin with the weight. The cattle are killed Friday and Saturday, the quarters stay in the refrigerators untouched on Sunday, are bagged Monday and Tuesday, and on Thursday are run out of the refrigerators to barges, and so to the steamers sailing on Saturday. The following table shows the total shipments of live cattle and quarters of beef for 10 years from the port of New York:

	Live cattle.	Qrs. of beef.
1890.....	166,891	598,378
1889.....	127,700	512,719
1888.....	55,658	341,672
1887.....	33,428	257,074
1886.....	53,148	336,153
1885.....	61,191	393,298
1884.....	54,105	413,955
1883.....	67,964	384,162
1882.....	18,939	222,413
1881.....	38,523	287,302
Grand total for 10 years.....	673,547	3,753,126

The dealers think it not probable that the phenomenal figures of live cattle exportations in 1889 and 1890 will be equalled again soon.

S. W. Allerton, of Chicago, is mentioned as a chief member of a powerful interest which is engaged in promoting the above scheme. Mr. Allerton says that they have built an abattoir at Philadelphia, and are constructing another large one in that city. Besides those in New Jersey, they have one in New York, and will build another this year. Representatives of Armour, Swift and other Chicago butchers say: "There's nothing in that scheme. It's a big bluff by the Pennsylvania lines to catch the dressed-beef men."

The advantages and disadvantages of membership in the Relief Department of the Pennsylvania Company have been the subject of correspondence in Pittsburgh

newspapers, but it is not easy to get at the real merits of the discussion, as neither side manifests a disposition to be frank. The allegations that employes are coerced into joining, or are got rid of if they stay out, are persistently kept up but the other side as strenuously denies them. Interested parties evidently work up "sentiment" where no legitimate feeling exists, and an attempt has been made to get the Pennsylvania legislature to forbid railroads participating in any insurance scheme. The only argument presented that makes any show of reason is that certain classes of men who are but little exposed to accident have to pay in a good deal of money while drawing out none. A game in which one has to die (or even be sick) to win does not suit their taste. This grievance has also been presented on behalf of certain flagmen and trackmen of the Philadelphia & Reading. A member of the Pennsylvania Association says that he has to contribute to charity subscriptions the same as before the establishment of the organization, and he naturally wishes membership were compulsory. It would save him \$3 a month, he says. The claim that compulsory membership in an insurance organization is a hardship would appear to be discounted somewhat by the following extract from the last annual report of the Baltimore & Ohio Relief Department:

During the year the Columbus & Cincinnati Midland became a part of the system of this company, and the operations of this department were extended to the employes of that company, the conditions being the same as observed originally in the organization of the department—namely, that membership should be optional with those already in the service, without respect to their age or physical condition; but that new employes could come in only on the conditions provided for like employes of the B. & O. No difficulty was experienced in securing membership from all the old employes, whose physical condition was very favorable. The medical examiner in charge reported that these men regarded it as a great benefit and privilege.

This report, which is dated Oct. 1, 1890 (though just issued), says that the pension feature of the organization has 166 members on its list, and paid out \$25,101 on this account during the year. The savings feature, which is virtually a building and loan association, has \$500,813 in deposits, and paid for the year an extra dividend of one per cent., thus netting the depositors five per cent. in the aggregate. Contracts have been made with a sufficient number of surgeons located at convenient points to attend employes or other persons injured by the company. Heretofore each member had the privilege of selecting his own surgeon, provided the fees conformed to those prescribed by the department, but it was found that there were many abuses. It is now expected that the expenses of the department in this respect will be materially lessened.

Track tanks have been completed at Green Brook, near Dunellen, on the Central of New Jersey and on the Delaware River Bridge of the Philadelphia & Reading, and the through trains of the Bound Brook route can now run through between Jersey City and Philadelphia, 80 miles, without stopping. Arrangements will at once be made for the engines of all the through trains to go through, thus simplifying the runs. The saving in time will not be very great, however, as the change of engines heretofore made at Bound Brook was accomplished very quickly, and obviated the necessity of taking water on the road at all, while now the speed of the train will have to be slackened twice for that purpose. The schedules of the Washington trains are so short that there will still be ample opportunity for exhibiting the qualities of the fast locomotives of the line. A careful observer said the other day that he had recently ridden three miles in 140 seconds (77 miles an hour) on a five-car train between the Delaware River and Bound Brook. This is about the best time heretofore reported with a four-car train.

Two coaches were burned in the Cincinnati, Wabash & Michigan yards in Anderson, Ind., on Friday last. The train had been made up to go north, but just before time to pull out of the yards a lamp in one of the coaches exploded, and two coaches were burned, as stated. The cause of the explosion is not yet ascertained, but it is under investigation. This is an accident of special importance as bearing on the safety of lighting with mineral oil, and the results of the investigation will be looked for with unusual interest.

The committee on railroad terminals of the Western Society of Engineers are now inspecting terminals in several of the eastern cities, including Philadelphia, Baltimore, Jersey City, Detroit and Port Huron. Upon their return, about April 1, they will make a report as to the best plans for terminals in Chicago.

NEW PUBLICATIONS.

Preliminary Survey and Estimates. By Theodore Graham Gribble. London and New York: Longmans, Green & Co. 1891. Price, \$2.25.

This is a handy volume of 420 pages, written by an English engineer who has had several years of experience abroad, part of which was in Canada. There are nine chapters and an introduction. The titles to these chapters are: I, General Considerations on preliminary railroad location; II, Route Surveying or Reconnaissance; III, Hydrography and Hydraulics; IV, Geodetic Astronomy; V, Tacheometry; VI, Chain Surveying; VII, Curve Ranging with Transit and Chain; VIII, Graphic Calculation for Preliminary Estimates; IX, In-

struments. There are also 69 short tables on various subjects, 133 cuts mostly distributed through the book, a glossary, and a mileage index.

The object of the writer has been "to present to the young [English] engineer going abroad a handy *vademecum*, which, with the necessary tables, will enable him to carry out a survey in a new country rapidly, correctly and according to the ideas and requirements of the people." He seems to have had railroads principally in mind, and yet his work by no means supplies the place of an American "field book." The author was evidently astonished when he went abroad to find out how little he knew of American methods of surveying. He has learned some things well and some others not so well, and now makes a commendable effort to enlighten his fellow engineers of like home training. The book is interesting to an American engineer principally as exhibiting the hybrid character of the practice which results from such a personal experience. Neither the instruments nor the methods described are those of the United States. There is lack of logical arrangement, and the same subjects may be found treated in various places in the book. In the chapter on "Hydrography and Hydraulics," which covers 36 pages, we find the following sub-headings: Hydrography on Land, Coast Lining on Foot, Surveying with Boats, Surveying from the Ship, Gnomonic Projection, Signaling with Heliostat and Heliograph, Flag Signaling, Army Flag Drill, Standard of Efficiency, Tides and Currents, Datum, Tide Gage, Hydraulics, Discharge from Tanks, Pipes, Cisterns, and Weirs; Horse Power of Falling Water, Efficiency of Water Wheels, Horse Power of a Running Stream, Hydrostatics, Cost of Dredging, Dredging Plant, Borings, Concrete, Dock Walls, Cost of Docks per Acre, Graving Docks. From this, which is a fair specimen, the miscellaneous character of the work can be inferred. It is a mixture of Trautwine's "Pocket Book," Wellington's "Economic Location of Railways," a railroad field book, and an English text-book on surveying instruments and methods.

The slide rule is treated at great length, and many problems are used to illustrate its use, which is constantly insisted on.

The subject of stadia surveying is treated at some length in the chapter on Tacheometry, a term which is largely used in England to designate a method which is scarcely practiced there at all. The author has evidently had a limited experience with these methods, but those described are far from being the practice in the United States. He seems to have never heard of either graphical or tabular reductions of the readings for horizontal and vertical distances, and works everything out with the slide rule. He recommends holding the stadia rod at right angles to the line of sight, which is almost never done in America. His methods of reading the rod, and of keeping and working up the record, are also much more complicated than those in common use in this country and described in the standard works on that subject. He recommends ranging out railroad curves with the stadia rod by means of the deflection angles and the long chord, a much more tedious and less accurate method than with the 100-ft. chain.

Under the head of Tide Gauge we find the only reference in the book to river currents and measurements, except a general discussion of Kutter's formula. This reference is as follows: "The velocity of river currents is best taken by current meter, unless sufficient time is available for obtaining the data required by Kutter's formula." The author is apparently one of those who feel that the accuracy of a result is commensurate with the complexity of the mathematical labyrinth from which it has been evolved. He seems not to know that the crudest possible observation of a river velocity is far superior in accuracy and credence to the most refined application of formulae to such functions as slope, cross section, and character of surface. No description is anywhere given of a current meter, or a method of using it.

It is quite possible the book may be valuable to those for whom it was written, and prove for such the "*vademecum*" it was intended to supply. There cannot be any demand for such a work in America, however, where we already have so many superior works covering this field. It is not to be expected that American methods of surveying will ever be adopted in England, but when the English engineer comes to America he would be much more likely to succeed in any department of surveying if he should follow the standard American works than if he should take for his guide such a confusing compromise of methods as Mr. Gribble offers him in this book.

Indian Railroad Notes.

I.

Although the controversy on the brake question still continues, the matter has already been finally settled so far as rolling stock for passenger traffic is concerned. Rather more than a year ago the Director-General of State Railways ordered all vehicles in use on the heavy gradients of the Frontier Railway to be fitted with the automatic vacuum brake. An indent was at once sent to England, and a large portion of the material has already arrived and is being fitted up. The East Indian Railway has also ordered sufficient of the same material for its fast passenger and mail trains, and by the end of June next the most important passenger trains between Calcutta, Bombay and Kurrachee

will all be equipped with continuous automatic brakes of the same pattern. As all railroads in India will become state property within the next 25 years, the government is not likely to sanction the introduction of any other pattern or system of brake, and, for many reasons, it is not desirable that it should do so. In the first place, all the broad gauge lines are already connected with each other, or will be very shortly, and rolling stock is constantly being interchanged. To allow the different companies to use any brake they choose would be to invite a repetition of the disasters which have occurred in Europe and entail endless complications. Secondly, it is often necessary to lend the freight cars which are lying idle on one line to another where the traffic is abnormal, and it may at any moment be found necessary to send the whole of the passenger stock from all parts of India to the Frontier Railway with troops.

The heaviest trains, coal or freight, weigh 1,080 tons, and the total length, including engine, is about 1,200 ft. On most broad gauge lines screw couplings are used for both passenger and freight vehicles, and no slack is allowed. When at rest the buffers touch each other; but there is a little play when running, owing to the compression of the drawbar springs. Automatic couplers have not been introduced; still there are very few accidents.

Economy is still the order of the day, and on some railroads the falling off in receipts, due to increased competition, fluctuating exchange and unfavorable rates, has been more than met by the reduction in working expenses. For the year ending Dec. 31, 1890, the working expenses of the Madras Railway were only 35 per cent. of the receipts, although the previous year they were 56 per cent. On the East Indian Railway the percentage of working expenses for the past year was 32.00 of the receipts, and, as the heads of departments are still trying to improve matters by abolishing all unnecessary posts and simplifying returns, etc., the present year should show even better results.

The Delhi-Kalka Railway, which is to be worked by the East India Railway, was to have been opened on the 1st of February, but the Government Consulting Engineer was not satisfied with the condition of the permanent way and postponed the opening for one month.

The last mail train from Howrah (the terminus of the East Indian Railway, opposite Calcutta) to Kalka, which is only a few miles from Simla, will be by a long way the fastest train in India, as the journey will only occupy about 36 hours, a boon which will be duly appreciated by those who can afford to spend the hot weather months in the summer capital of India.

The Secretary of State for India has sanctioned the estimate for the high-level line between Hirok and Kotai, amounting to nearly 15½ lacs of rupees, and the low-level line, which is washed away every year, is to be abandoned altogether. The Zhoob Valley survey is said to be progressing favorably, and as this is being carried out entirely by Royal Engineers the completion of the work will be watched with interest, especially by their comrades in civil employ, who have hitherto asserted that their military brethren are more ornamental than useful.

The formation of a Railway Service Corps has again been taken in hand. More than 50 per cent. of the Europeans and Eurasians in railroad employ belong to the volunteer forces, but this is not considered sufficient, and a certain number of young soldiers are to be trained as engineers, stokers, conductors, etc. This is an important matter, for a large proportion of the native staff would be useless in time of war, even if they remained loyal to the British government—a very doubtful matter.

The opening of the Khojak tunnel will take place in March next, and the Bengal-Nagpur Railway will be opened on the same date. This last will considerably shorten the journey between Calcutta and Bombay, and will open out a large tract of country where coal and other minerals abound. There are also large forests of timber suitable for ties, and there will be a heavy traffic in cotton, grain, etc. Wooden ties are, however, at a discount just now, and on all State railroads steel, trough-shaped ties are being used wherever possible.

In Burmah railroad construction is being pushed on rapidly, and this will no doubt do more toward tranquilizing the country than any number of military police.

Sanitary and hydraulic engineers have a fine field before them in India, now that all places of importance require water-works, and are trying to introduce improved methods of sanitation. The orthodox Hindoos of Benares object strongly to the Holy Ganges being polluted by sewage, and Mr. Baldwin Latham has therefore recommended that a quantity of waste land near the city be used as a sewage farm, which he points out will not only remove the difficulty but will also be a source of profit to the municipality.

NUT LOCK.

CALCUTTA, Jan. 26, 1891.

The Census Bulletin on the Freight Traffic of the Great Lakes.

Census Bulletins Nos. 28 and 29 are devoted to the lake traffic; and although it is said that Mr. Charles H. Keep, the special agent gathering the statistics, did not carry his researches as far as strict accuracy required, the figures presented show the grand aggregate. It is explained that, unlike our foreign commerce, the commerce

on the lakes cannot be measured by the aggregate of receipts and shipments from each port, as that method would result in duplications; consequently, in such case either the receipts or shipments from the port were taken, depending on which happened to be the largest, as giving the best practicable result. It is urged by critics of the returns that greater accuracy would have been obtained by interviewing the captains of all craft engaged in the carrying trade, an accuracy which, it is claimed, would have prevented the aggregate of discrepancies between receipts and shipments, amounting to 11.6 per cent., though the balance of discrepancies is 2.58 per cent. of the total. Some of these discrepancies are explained by reference to trade via and through Canada, e. g., the shipments of corn exceeded the receipts, by 12,578,611 bushels, but 11,135,213 bushels was either exported to Canada through the Welland Canal or shipped via Sarnia, which brings the apparent discrepancy down from 17.92 per cent. to less than two per cent.

All are conversant with the fact that the tonnage passing Detroit in seven months exceeds the aggregate tonnage of London and Liverpool for the year, and that the traffic through the canal at the "Soo" for the past two years has been greater than that through the Suez Canal. So the statement that 27,469,290 net tons of freight was transported an average distance of 568 miles on the Great Lakes will excite no surprise. The ton-mileage, 15,518,390,000, is equal to 22.6 per cent. of the total ton-mileage of our railroads; and as the second report of the Interstate Commerce Commission shows that the average freight charge on our railroads for the year ending June 30, 1889, was 9.22 mills per ton mile, the average freight charges by the "Soo" being only 1.5 mills, the Lake Carriers' Association claims a saving in transportation charges of \$119,801,734.

The following tables are condensed from the bulletin:

Cargo Tonnage on the Great Lakes for the Season 1870:

(Canadian coastwise trade excluded.)

Commodities.	Amount in net tons.	Percentages of commodities and class.
Aggregate.....	27,469,290	100.
Class I. Products of agriculture:		
Corn.....	1,929,914	7.03
Wheat.....	969,150	3.53
Mill products.....	992,066	3.61
Total.....	4,506,554	16.41
Class II. Products of mines and quarries:		
Coal.....	6,105,799	22.24
Iron ore.....	7,677,107	27.96
Total.....	14,418,551	52.62
Class III. Other products:		
Lumber.....	6,857,257	24.97
Total.....	6,921,985	25.21
Class IV. Manufactures, miscellaneous merchandise, etc.....	1,583,170	5.76

Three of the above commodities, coal, iron ore and lumber, comprise over 77 per cent. of the cargo tonnage of the lakes, and, if corn is added, four articles contribute 84.62 per cent. of the traffic.

The distribution of the traffic by the principal ports is as follows:

	Receipts.	Shipments.	Total.
Chicago, including South Chicago.....	19.55	11.35	15.59
Buffalo.....	15.69	10.62	13.11
Tonawanda.....	4.04	1.00	4.04
Escanaba.....	0.75	13.38	7.08
Cleveland.....	10.56	3.50	7.07
Ashtabula.....	8.59	1.94	5.26
Ashland.....	1.88	6.97	4.39
Milwaukee.....	6.11	1.39	3.78
Marquette.....	0.55	6.20	3.34
Superior.....	3.38	1.21	2.31
Duluth.....	2.63	1.71	2.18
Two Harbors.....		3.71	1.83

The tables showing the receipts and shipments of commodities are very full; for instance, salt furnishes 1.07 per cent. of the total traffic of the lakes, and it furnishes 1.61 per cent. of Chicago's traffic, 5.2 per cent. of the traffic of Milwaukee, 1.27 per cent. to Duluth and Superior, 16.67 per cent. to Manistec, and 9.12 per cent. to Ludington. The total movement of products of agriculture are given as below:

	Per cent. of total product of agriculture traffic.	Per cent. of total port traffic.
Chicago, including South Chicago.....	33.49	35.45
Buffalo.....	37.07	46.45
Superior.....	3.46	24.77
Duluth.....	4.39	32.57
Escanaba.....	0.05	0.13
Cleveland.....	0.30	0.70

Manufactures and miscellaneous merchandise contribute only 0.25 per cent. to the traffic of Escanaba and 0.85 to that of Marquette, while at Gladstone they contribute 2.19, and at Ashland 13.32 per cent. The maximum percentage, 39.20, mostly receipts, is found at Ludington. The heaviest shipments are from Buffalo and the largest receipts at Ashland.

The distribution of traffic by lakes is as follows in percentages of total traffic on the Great Lakes:

	Receipts.	Shipments.	Total movement.
Lake Superior.....	9.60	21.50	15.48
Lakes Huron and St. Clair.....	3.97	9.27	6.50
Lake Michigan.....	32.70	39.54	36.27
Lake Erie.....	49.36	25.28	37.78
Lake Ontario.....	1.87	3.05	2.45
St. Lawrence River.....	1.90	0.95	1.43

It will be seen from the above that both in shipments and receipts Lake Michigan does the largest business, with Lake Erie a good second; and while in shipments Superior is very close to Erie, it has less than one-fifth of its receipts.

TECHNICAL.

Manufacturing and Business.

The copartnership heretofore existing between Michael Schall and Arthur King, of York, Pa., under the firm name of Schall & King, and operating the Empire Car Works, at York, Pa., and the Middletown Car Works, at Middletown, Pa., has been dissolved by mutual consent. Arthur King will continue to operate the Middletown works.

Among recent shipments of cranes made by the Yale & Towne Manufacturing Co., Stamford, Conn., may be mentioned the following: One locomotive crane to the National Tube Works Co., McKeesport, Pa.; one 5-ton jib foundry crane to the Corning Iron Works, Corning, N. Y.; one 5-ton hand traveler to Guild & Garrison, Brooklyn, N. Y., and one 2-ton locomotive crane to the Illinois Central road.

The Brown & Sharpe Manufacturing Co., Providence, R. I., is building a new four-story brick building 100 ft. x 50 ft., the construction being similar to that of its main machine shop buildings, and practically fire-proof throughout. The walls are 20 in. thick, and have two ventilating flues 6 in. x 8 in. in each pier. The floors and roofs rest on iron beams, supported by three transverse rows of iron columns 16 ft. apart. The heavier beams are in pairs, and are 20 in. deep; the lighter beams are 15 in. deep and are 8 ft. from centre to centre, and support brick arches 4 in. thick, 10 in. rise. The floors are 5 in. thick. The first layer from beam to beam is 2½ in. splined spruce plank. The second layer is 1½ in. spruce laid diagonally with the plank, and the third, or top, layer is 1½ in. hard pine laid parallel with the 3-in. plank. The roof is solid concrete, covered with tar and gravel. The stairways are iron. The building will be devoted to the manufacture of a variety of small tools and instruments for accurate measurements.

The Westinghouse Machine Co., maker of the Westinghouse engines, has had no financial trouble. Instead of curtailing its operations it is increasing its capacity. New tool and store rooms are approaching completion, and it is hoped during the coming summer to add new erecting and testing shops, fitted with power cranes and all modern improvements, which will have a producing capacity twice as great as the present.

M. Lewinson and George A. Just have recently formed a partnership as consulting engineers and contractors, with office at 90 Nassau street, New York City. The firm will make a specialty of designs for engineering structures in iron and steel, and is prepared to build such structures.

The Robert Eastwick coupler has been put on the Barnum & Bailey circus train of 54 cars. These couplers have Johnson steel knuckles and malleable heads. The cars are partly new and are all fitted with the Westinghouse brake.

The Curtis steam-pressure regulator has been successful in locomotive work and in car heating as a uniformly acting reducing valve, but such work is not as exacting as some other purposes to which this regulator has been applied. For instance, in dairy work uniformity of rotation and temperature of the centrifugal cream separators is an absolute necessity and in governing the steam pressure which drives these separators, and at the same time maintaining a constant pressure for heating the same, this regulator has shown its fitness for the highest class of steam-pressure regulation.

The Norfolk Supply Co., with a capital stock of \$50,000, has been incorporated at Norfolk, Va., to manufacture railroad and steam boat supplies. B. D. Groner is President of the company, T. E. Elliott, Vice-President, and F. J. Bain, Secretary.

The firm of A. Whitney & Sons, of Philadelphia, car wheel manufacturers, is reported to be financially embarrassed. The firm is now composed of John R. and James S. Whitney, sons of Asa Whitney, the founder. The works were built in 1848. The firm makes a chilled cast iron car wheel.

The Curry Signal Co. has been incorporated at Danville, Ky., with a capital stock of \$100,000, to manufacture the Curry automatic railroad signal. The incorporators are G. W. Welsh, D. M. King and T. P. Curry.

New Shops.

The Chesapeake & Ohio will, it is stated, establish machine shops at Lexington, Ky., and new car shops at Newport News, Va.

The West Virginia Central & Pittsburgh will probably add car shops to its machine works at Elkins, W. Va.

Train Heating in Europe.

An appropriation of 80,000 marks has been made for the introduction of steam heating on Württemberg (Germany) State railroads. It is expected that the system will be in general use on the various lines next winter.

With reference to the heating of cars and stations on Swiss railroads, the Swiss government has formulated a code of rules, according to which passenger cars must be heated from the beginning of October until the end of April, providing the outside temperature falls below 41 degrees Fahr. During the months of December, January and February, however, the heating must be maintained without regard to outside temperatures, and may be discontinued only if during three days and nights in succession the temperature has not fallen below 41 degrees. The temperature of the cars must range between 50 and 65 degrees Fahr., with an average of about 60 degrees. The cars must be heated a sufficiently long time before being occupied to insure a temperature at starting of at least 50 degrees. Thermometers must be placed in every car. These regulations apply to stations also. Attention is further directed to the act of legislature of July 1, 1889, according to which all cars must be heated by steam within five years from that date.

The Jull Snow Plow.

The Jull Manufacturing Company has published several letters from officers of the Sioux City & Northern Railroad, the Illinois Central and the Pacific Short Line, concerning the performances of the Jull centrifugal snow excavator between Sioux City and O'Neill City in the early part of this month. Snow was found in the cuts drifted from 8 to 15 ft. deep, and in a few cases cuts were found with 20 ft. of snow in them. The cuts were from 300 to 2,000 ft. long. The railroad officers say that the excavator went through these from 6 to 8 miles an hour, throwing the snow clean out of the cuts, much of it beyond the right of way fences. On the western end of the line the snow had been in the cuts about a week and was badly mixed with sand. The plow did not delay whatever. The letters mention no objections to, or defects in, the machine, but are highly commendatory.

The New Indian Head Proving Grounds.

The new government proving grounds for heavy ordnance and armor plates at Indian Head, Md., are about ready for occupation and use. They are situated some 25 miles from Washington, while the old Annapolis grounds are 40 miles away. The new grounds cover some 660 acres on the Maryland side of the Potomac River and have a water frontage of about one mile in length. For long-range firing there is a straight stretch of about 12 miles down the river, while a natural ravine with high bluffs on each side furnishes first class accommodations for short range firing. A dock and railroad tracks are provided leading from the water front to the proving grounds, and a specially constructed barge having track rails on deck carries the heavy materials and ordnance from Washington to Indian Head. By such conveniences a heavy gun can be moved from the Navy Yard tracks at Washington on to the barge rails, thence transported to Indian Head by water, transferred to the tracks on the dock, moved to the proving grounds, tested and returned to Washington in a single day if found necessary. The Annapolis grounds will be abandoned with the opening of the new ones. The first important test to occur on the new grounds will be of five new experimental armor plates, now being made by Carnegie, Phipps & Co., at Pittsburgh. One plate is to be of a special Pittsburgh all-steel mixture, one of the Harvey all-steel process, one of Harvey nickel-steel and two of experimental nickel-steel mixtures. All the plates are to be 3 in. thick and 8 ft. by 6 ft. on the face, and suitable guns, ranges and charges will be used for the 3-in. thicknesses.

Liquid Fuel for Locomotive Engines.

The marked increase which has taken place during the last two years in the price of steam coal for locomotive engines has led to experiments to see whether a substitute for the solid colliery fuel could not be found. The Great Eastern Railway Co. took the initiative in the matter, and, it is now said, with undoubted success. They had tried some successful experiments with liquid fuel, tar, oil, etc., and were induced to go farther in the matter. It is smokeless, without smell, and will, if brought into use, save expense in fuel on the suburban lines. As the result of these and other experiments, it appears that Mr. Holden, the Locomotive Superintendent of the Great Eastern Railway Co., has taken out a patent for an "injector," which is now applied to about a dozen of the locomotive engines of the company, and has proved to be an undoubted success. The fluid used as an auxiliary to the coal is simply tar, to which is added some green oil from the works where the tar is produced, the cost being about 1½d. a gallon. Each engine uses about 12 lbs. of coal and one gallon, or 11 lbs. of fluid fuel per train mile, as against 34 lbs. of coal. The relative cost is less than coal at the present prices of both, but the actual value of the "injector" is especially seen on gradients when steam can be got up instantly by simply touching a tap close to the driver. It is also stated that two well-known engineers in the metropolis have patented a system by which a ton of residual oil, costing £3 10s., may be made to create 8,000 horse power for a space of one hour, and generally do 20 times the work of coal.—Iron and Steel Trades Journal.

Grand Trunk Rolling Mills.

Montreal is to have a new industry in the shape of rolling mills and forge, which are to be erected by the Grand Trunk road. Work on them is to be commenced at once, and the mills are expected to be in full operation before next autumn. The Grand Trunk has long proposed to manufacture the bar iron required for the various purposes of locomotives and cars and car axles. The saving to be effected is estimated as at least \$30,000 per year in the heavy duties. The officials say that the heavy duties, and the fact that there is little competition between mills in Canada, has rendered the erection of rolling mills advantageous. The plant and buildings will probably cost in the neighborhood of \$50,000. The buildings will be erected parallel to the present smith's shops at Point St. Charles, and will be 200 ft. long by 75 ft. wide. The works will be provided with a 12-in. mill, and with the necessary hammers and other plant. The output is expected to reach 4,000 tons of iron yearly. Mr. Herbert Wallis, Mechanical Superintendent of the Grand Trunk, has charge of the erection of the buildings.

The Johnston Electric Train Signal.

A train on the New York & New England road, running between Boston and Norwood, will be equipped with the Johnston electric train signal, illustrated in the Railroad Gazette of Jan. 31, 1890.

General Manager Howard, of the New York & New England, proposes to give the device a thorough test. Several other roads, including some of the Western lines, are contemplating its adoption. All the cars of the Boston, Revere Beach & Lynn road are equipped with the device.

Car Heating.

The Safety Car-Heating & Lighting Co., of New York City, has closed contracts with the New York, New Haven & Hartford to equip 50 passenger cars of that company with apparatus for continuous steam-heating. By the system adopted the steam pipes will be kept outside of the cars, which will be heated by hot water circulation, the water being heated by the steam.

Ventilated Fruit Cars.

The "Pancoast Aerator" car, fitted up last season by the Pennsylvania Railroad Co., has gone to Florida, where it is to be tried at the earliest opportunity with strawberries for the North. If it succeeds, it is said that these will be the first strawberries successfully shipped from there to Northern markets without ice. The Baltimore & Ohio car, similarly fitted, has gone to Southern California to be loaded with oranges for Philadelphia. April and May shipments in other years, in other ventilated cars, have incurred losses of about 50 per cent., which this new car aims to prevent.

THE SCRAP HEAP.

Notes.

Employees of the Lake Erie & Western are being tested for color blindness, and also on the sense of hearing.

The Baltimore & Ohio freight house at South Chicago, Ill., was burned last week. The loss, including cars and other property, was \$100,000.

A Denver paper states that the Union Pacific order directing operators to withdraw from the Order of Railway Telegraphers has been rescinded.

Two train wreckers were sentenced at Trinidad, Colo., last week to nine years each in the penitentiary. Their

crime was committed on the Atchison, Topeka & Santa Fe last September, and their object was robbery.

The investigation of the burning of the passenger cars of the Jacksonville Southeastern Railroad, near Havana, Ill., shows that the fire originated from the stove in the Santa Fe baggage car, and in the opinion of the officers of the road the fire was undoubtedly helped on by the oil from the lamps. There were five cars burned, two day cars and two sleeping and a baggage car.

About 30 yardmen on the Central of Georgia and Atlantic & West Point roads at Atlanta struck last week for an increase of pay. It is said that the pay of the yardmen of the Western & Atlantic was raised by the new management of the road unintentionally (through the mistake of a subordinate officer), and that this was what started the men on the other roads. The strikers' places were filled by men brought from other cities. This strike was the only basis for the dispatches published in various papers stating that 1,000 men had quit work.

There are now several large crevasses in the Mississippi levees, and dispatches to the New York Herald state that the damage will be widespread. The Ames crevasse, opposite New Orleans, will affect eight parishes, and that at Concordia will flood the section overflowed by the Raleigh crevasse last year. The Southern Pacific and Texas & Pacific have both been obliged to abandon their roads west from New Orleans, several miles being submerged. It is said that the latter road will take passengers across the river by boats at a point 17 miles above New Orleans.

Foreign Notes.

Rome is soon to have a commercial museum which will contain a permanent exhibition of products of Italy, as well as of other countries. These products will be carefully catalogued, and the catalogues are to be made generally available. There will be an executive committee, who will furnish desired information regarding the exhibits, and who will represent the exhibitors in effecting sales and purchases. A reading-room will contain all the principal journals bearing on economical and industrial subjects, besides tables giving railroad changes, custom duties, etc.

Trials of compound locomotives have recently been made on the royal Hungarian railroads. The results are said to have been favorable to the engines, and the latter will probably be used for express train service.

Taxing Railroads in Iowa.

The Executive Council has completed the task of assessing the railroad property of the state for taxation. The total amount was raised from \$42,858,800 to \$44,506,570. The Chicago, Burlington & Quincy and the Chicago, Rock Island & Pacific were not changed. The Chicago & Northwestern was raised \$1,000 per mile, as were also the Illinois Central and the Chicago, St. Paul & Kansas City. The assessment on several of the smaller roads was reduced. The net increase is \$1,607,627, and the increase of the assessment of the Chicago & Northwestern alone is \$1,150,500.

The Inalienable Right to Arbitration.

W. B. Shattuc, O. G. Murray and H. W. Fuller, the arbitrators appointed by the Western Passenger Association to decide on the ruling of Chairman Finley denying the right of appeal to arbitration to the Atchison, Topeka & Santa Fe, have made a long report. Chairman Finley decided in December that the Atchison's appeal from the chair's order acted as a bar to arbitration. The finding of the arbitrators is to the effect that by the articles of agreement the right of arbitration is substantially vested, and, if demanded within the five-day limit, overrides any questions of parliamentary proceedings or decision of the chair according to the usual rules. The arbitrators advise that the issue be remitted to proceedings before arbitrators, as though no appeal from the chairman's decision had been presented to the association.

Railroad Commissioners on the Tunnel Collision.

The New York State Railroad Commission has completed its investigation of the Fourth avenue tunnel accident. The Board holds that lighting the tunnel by electricity would tend to make signal lights less visible. As regards ventilation a feasible plan is to close entirely the openings between the centre and side tunnels and construct ventilating towers at certain points from the side tunnels in such a manner as to produce a strong draft through the side tunnels. The Board will have more to say on this subject, but in the meantime recommends the road to improve the audible signal, and approves of the companies' again adopting the torpedo in addition thereto; that additional measures be adopted for constant inspection of the lights and wires moving the signals, and that an electric device be adopted to show to the operator in the cabin the position of the signals; that no engineer or fireman be permitted to run a locomotive through the tunnel except he has a certificate of perfect eyesight and perception of color; that no train be permitted to pass through the tunnel at a greater speed than 15 miles an hour, the rate to be reduced under unfavorable conditions to a rate slow enough to insure the engineer and fireman seeing the signals, until improved methods shall have been adopted which shall demonstrate to the satisfaction of the Board that such a reduction in speed is no longer necessary; and that the railroad companies investigate and consider the best methods to be adopted to ventilate the tunnel and report to the Board their conclusions with a view of recommending legislation necessary to carry the same into effect. Uniform speed would be impracticable. Two signalmen are more likely to create confusion than one careful man with an interlocked electrical system in operation. In conclusion, the Board finds that Lewis Fowler, engineer, and Charles A. Wellington, fireman, were directly responsible for this accident, and that the New York, New Haven & Hartford road is directly responsible for the death of the victims of the accident, in so far as such death was contributed to by the burning of the cars, because of the failure of the company to conform to the law requiring its cars to be heated by means other than by stove or furnace.

LOCOMOTIVE BUILDING.

Three new locomotives, built at the Canadian Pacific shops in Hochelaga, Que., have been added to the rolling stock of the road.

Since the middle of February the Grand Trunk shops at Point St. Charles, Que., have been turning out engines at the rate of one a week. In the next six months it is expected that 15 more new engines will be built at the shops. The Canadian Locomotive & Machine Co. at Kingston, Ont., is finishing its order for 10 engines at the rate of one a week.

The Concord & Montreal has received this week two

new 10-wheel passenger engines from the Manchester Locomotive Works. The engines have 18 x 24 in. cylinders, 57-in. driving wheels, 60-in. boiler shell, and 225 tubes, the grate tubes being 78 in. long. The weight is 57 tons.

The New York, Providence & Boston is having two locomotives built at the Manchester Locomotive Works, in addition to the three six-wheel switching engines which are being built by the Rhode Island Locomotive Works. The engines are of the American type, with 17 x 24 in. cylinders and driving wheels 5 ft. 6 in. in diameter.

The Rhode Island Locomotive Works will deliver this week to the New York, New Haven & Hartford five American type engines with 18 x 24 in. cylinders and 68 1/2 in. wheels. Two mogul locomotives with 19 x 24 in. cylinders have been shipped to the Fort Worth & Rio Grande. The works now have orders for about 21 locomotives. These include four 19 x 26 moguls for the Maine Central, three 18 x 24 six-wheeled switching engines for the Old Colony, two 18 x 24 mogul and three 17 x 24 for the Milwaukee, Lake Shore and Western, six 17 x 24 for the Wabash, and three 19 x 24 for the Mexican Central. All these locomotives except the moguls are six-wheel switching engines.

CAR BUILDING.

The Concord & Montreal has just completed 200 platform cars at the Lake Village (N. H.) shops.

By next October the shops at Point St. Charles, Que., will be building 10 new cars, similar to those run on the elevated roads in New York, for the new belt line at Toronto. The Grand Trunk is also commencing to build box cars having a capacity of 60,000 lbs.

BRIDGE BUILDING.

Austin, Tex.—It is stated that T. E. Anderson and others of Austin are interested in establishing bridge works at that town.

Baltimore, Md.—The city and the Baltimore Belt road will jointly construct a bridge over North avenue, at a cost of \$304,000, of which \$281,000 will be charged to the city, \$5,000 to the water works, and the remaining \$104,000 to the railroad company. The bridge proper will be 400 ft. long, constructed of black slate stone with marble trimmings. It will have three stone arches, of 135 ft. span, and 100 ft. wide over all, with one roadway of 60 ft. and two sidewalks of 17 ft. 6 in. in width each, inside of the parapets.

Belleville, Ont.—The Bay of Quinte Bridge, which connects Belleville with Ferry Point, County of Prince Edward, and which has been in course of construction for nearly two years, was completed and opened for traffic on Saturday. Its total length is 1,808 ft. It has 13 spans 98 ft. long, two 148 ft., one 60 ft. and a swing 238 ft. long. The total cost of the work, which was carried on under the superintendence of Mr. Keefer, of Ottawa, will be about \$105,000.

Bryson City, N. C.—Bids are invited by E. Everett, of Bryson City, for constructing an iron bridge, with approaches of 70 ft. on one end and 20 ft. on the other, a roadway of 18 ft., one sidewalk 5 ft. wide and stone abutments 22 ft. 6 in. high.

Dallas, Tex.—Contracts for a wire cable suspension bridge 120 ft. long have been let by the County Commissioners at Dallas. The bridge is to be constructed across the South Sulphur River.

Goliad, Tex.—A bridge is to be built across the San Antonio River, 18 miles above Goliad.

Marksville, La.—The Pittsburgh Bridge Co. of Pittsburgh, Pa., has been awarded a contract for the construction of bridges across Bayou du Lac and Bout du Bayou, near Marksville. The work is to be done for \$19,400.

Montreal, Que.—The Montreal Bridge Co., which obtained a charter last session to construct a railroad bridge across the St. Lawrence River at that city, is applying to parliament for an amendment to the charter, reducing the height of the bridge to 150 ft. above the water.

Pulaski, Va.—The Pulaski Bridge & Iron Co., with a capital stock of \$350,000, has been incorporated at Pulaski City, for the purpose of erecting bridge and structural iron works.

Tennessee.—Bills have been introduced in the Tennessee Legislature authorizing Cheatham County to issue \$10,000 of bonds for building bridges and authorizing Rhea County to issue bonds for building bridges.

Washington, D. C.—A steel cable bridge is contemplated at Washington, D. C., on the property of the National Chautauqua.

RAILROAD LAW—NOTES OF DECISIONS.

Carriage of Goods and Injuries to Property.

In Texas it is held by the Supreme Court that under the constitution providing that "no person's property shall be taken, damaged or destroyed for or applied to public use without adequate compensation being made," one can recover for diminution in the value of his property arising from the noise, smoke and vibration produced by the operation of a railroad near the property, though not along a public highway.

In the same state it is laid down that the railroad does not get the fee of land condemned for depot purposes, and therefore, where it permits a party to use part of the premises condemned for depot grounds for storing lumber shipped to him over the railroad until sold, and allows him to erect thereon an office and a shed for protecting dressed lumber, the owner of the fee can recover from such party the rental value of the premises for a lumber-yard, as the railroad company neither has the right to use the premises for such purposes, nor to permit others to so use them.

In Georgia the Supreme Court holds that though land in the possession of tenants has been condemned as the property of taking for a railroad's right of way have been paid to him, the company is liable to the tenants for injuries to crops occasioned by cattle getting in, where it was due to the removal by the company, after the condemnation, of cattle guards maintained by it theretofore.

In Minnesota the Supreme Court rules that the mere fact that a railroad is within the limits of an incorporated village does not exempt the company from the statutory duty of inclosing the track, where practicable, by fences and cattle guards.

The California code provides that "a bell . . . must be placed on each locomotive engine, and be rung at a distance of at least 80 rods from the place where the railroad crosses any . . . road, . . . and be kept ringing until it has crossed such . . . road, or a steam-whistle must be attached and be sounded. . . . The corporation is also liable for all damages . . . caused by locomotives, trains or cars when the provisions of this section are not complied with." In an action for killing plaintiff's horse at a crossing the evidence was conflicting as to whether the required signals were given. The Supreme Court holds that it was proper to instruct that, if the signals were not given, defendant was *prima facie* liable for the damages, unless plaintiff's negligence contributed thereto.

Injuries to Passengers, Employees and Strangers.

In the Federal court it is ruled that where a passenger sought to buy a ticket but could not because the agent had left the office and gone to meet the train then standing at a water tank 200 ft. away, and the passenger refused willfully and capriciously to pay the conductor 25 cents in excess of the regular fare and take a rebate check (the requirement of the conductor being in accordance with his instructions and having the sanction of the railroad commission of the state) and this refusal persisted in until the train was stopped, the conductor was authorized to put the passenger off the train.

In Louisiana a passenger on a railroad, upon arriving at his destination, contracted with a transfer company to procure his baggage from the depot and deliver it at his residence, and he surrendered his checks to the company. It then refused to deliver the baggage to him until it was paid certain extra charges for transportation claimed by the railroad company, though the owner tendered the price agreed to be paid for its own service, and, on his refusal to pay these extra charges, it retained his checks for a time, and then gave them up to the railroad company. The Supreme Court rules that, under the contract, the transfer company was responsible for the delivery of the baggage, and the owner might enforce his rights against it by suit and sequestration.

In Wisconsin the plaintiff, having a ticket over another line, got by mistake on defendant's train. Not having any money she could not pay the fare demanded by the conductor, and he put her off at a small station through which the line she should have taken ran. The depot was closed at the time, and a dwelling house near by was also shut up on that day. Plaintiff with her two children had to wait several hours for the train, and the exposure to the cold brought on a serious illness to plaintiff. The Supreme Court holds that the railroad is not liable in punitive damages.

In Maryland the Court of Appeals rules that a passenger on defendant's train being injured immediately after alighting from the train at a station, by defendant's locomotive on another track close by, the burden of proof was on defendant to show that it was not negligent.

In Georgia it is held by the Supreme Court that where a railroad permits a construction company to operate the road and receive the earnings thereof for a certain time the railroad company will still be liable for any injury occurring through the negligence of the construction company in carrying passengers.

In Michigan it is held that a car inspector is not a "fellow servant" of a brakeman.

In Michigan the Supreme Court rules that the negligence of a car inspector, whose duty it was to inspect the cars and apparatus, in permitting a defective chain to be put on the car, is the negligence of the company. In this case a brakeman was thrown off the car and killed by the braking of the chain which connected the shaft that he turned with the brakes. The link which parted was joined with a smooth "cold shut," instead of being properly welded, and the defect was discoverable upon careful examination. The Supreme Court holds that the company was liable in providing a chain in which existed this visible imperfection.

In Texas a drawhead pulled out while the train was running. The spring attached to it, which prevents the cars coming as close together as they otherwise would, dropped out, and was not found, and, under orders of the baggage master, who was his superior, the brakeman replaced the drawhead without it. During the run he made a coupling between that car and a stock car, which, like the others of its class on the road, had no bumpers. It being night, he did not observe that one of the cars had the defective drawhead, and he was caught between the two, and injured. He had been 18 months in the service. The Supreme Court rules that there was no evidence of negligence on the part of the company.

In New York the Supreme Court holds that where a person starts to cross the track as soon as the rear of the train from which he had alighted has passed him, without turning his head in either direction to see if any train is coming, and regardless of a caution given him by the conductor, he is guilty of contributory negligence, and no recovery for his death can be had of the company.

In Georgia, the plaintiff was walking through defendant's yard, which the public were forbidden to do by signs posted therein; and while he was trying to get out of the way of one engine he was struck by another. The engineer and fireman testified that they did not see him. The Supreme Court rules that the evidence would not support a verdict for the plaintiff, he being a trespasser.

In Missouri the Supreme Court rules that the statute fixing the amount of recovery for injuries resulting in death "caused by the negligence, unskillfulness or criminal intent of any officer, agent, servant, or employee while running any locomotive or train of cars" at \$5,000 embraces an injury caused by a failure to light the headlight of the locomotive.

In Wisconsin the plaintiff testified that he looked for the train when between 50 and 60 ft. from the crossing, and there is evidence that he could then have seen the train had it been within a certain distance of the crossing. If the train had been that distance away, and running at statutory speed, plaintiff would have passed beyond the crossing before the train reached it. The Supreme Court rules that it could not be said, as matter of law, that plaintiff was negligent in failing to look again for the train on approaching the track, though he could then have seen a greater distance in the direction of the train, and might have stopped his team instantly, as he had a right to assume that trains were moving at lawful speed.

In Missouri, the Supreme Court holds that a person who attempts to cross a street which is obstructed by a train of cars, by stepping on the coupling-pins, and climbing across, without looking to see if there is an engine attached, is guilty of such contributory negligence as will prevent his recovery from the railroad company for injuries sustained by the sudden starting of the train.

In Virginia, in an action for death caused by a passing railroad train to an employee of a firm of contractors engaged in removing rock and earth in order to straighten the track, there was testimony tending to show that the company had promised that its trains should not pass the point at a speed of more than six miles an hour. The Supreme Court holds that it was error to refuse a charge that, if the jury believed such promise was made, and that deceased's death was caused by a violation thereof without fault on his part, they should find for the plaintiff.¹⁹

In Iowa the Supreme Court rules that where defendant's track passed very close to the track of another company, and it was the custom of the employees of the latter company, not objected to by defendant, to step upon defendant's track in making signals, the signaling being done for the protection of the property of defendant as well as of the other road, an employee of such other road, who stepped upon defendant's track for the purpose of signaling, was not required "to look and listen."²⁰

In Missouri it is ruled by the Supreme Court that where a city ordinance requires the presence at a crossing of a watchman, "who shall display at the cars, in the daytime, a red flag," it is not sufficient if a watchman is present with a flag at the crossing; but he must also warn passers of the danger from approaching trains.²¹

- ¹ Gainesville, H. & W. R. Co. v. Hall, 14 S. W. Rep., 259.
- ² Lyon v. McDonald, 14 S. W. Rep., 261.
- ³ Rome & C. Co. v. Jennings, 11 S. E. Rep., 839.
- ⁴ La Paul v. Truesdale, 46 N. W. Rep., 363.
- ⁵ Orcutt v. Pac. Coast R. Co., 24 Pac. Rep., 661.
- ⁶ Harrison v. Fink, 42 F. 757.
- ⁷ Da Ponte v. New Orleans Transfer Co., South. Rep., 608.
- ⁸ Patry v. C. St. P. M. & O. R. Co., 46 N. W. Rep., 56.
- ⁹ Phila. W. & B. R. Co. v. Anderson, 20 Atl. Rep., 2.
- ¹⁰ Chattanooga R. & C. R. Co. v. Liddell, 11 S. E. Rep., 833.
- ¹¹ Morton v. D. R. C. & A. R. Co., 46 N. W. Rep., 111.
- ¹² Aorton v. Detroit, B. C. & A. R. Co., 46 N. W. Rep., 111.
- ¹³ Houston & T. C. Ry. Co. v. Barrager, 14 S. W. Rep., 242.
- ¹⁴ Meserole v. Brooklyn City R. Co., 10 N. Y. Supp., 813.
- ¹⁵ Rome R. Co. v. Tolbert, 11 S. E. Rep., 849.
- ¹⁶ Becke v. Mo. Pac. Ry. Co., 13 S. W. Rep., 1,053.
- ¹⁷ Piper v. Chicago, M. & St. P. Ry. Co., 46 N. W. Rep., 165.
- ¹⁸ Hudson v. Wabash W. Ry. Co., 14 S. W. Rep., 15.
- ¹⁹ Johnson's Adm'x v. Richmond & D. Ry. Co., 11 S. E. Rep., 829.
- ²⁰ McMarshall v. Chicago, R. I. & P. Ry. Co., 45 N. W. Rep., 1065.
- ²¹ Wilkins v. St. Louis, I. M. & S. Ry. Co., 13 S. W. Rep., 893.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

- Chicago, Rock Island & Pacific, \$1 per share, payable May 1.
- Cincinnati, New Orleans & Texas Pacific, 2 per cent., payable April 20.
- Missouri Pacific, quarterly, 1 per cent., payable April 15.
- Northera (New Hampshire), quarterly, 1½ per cent., payable April 1.
- Panama, 2 per cent., payable March 27.
- Pittsburgh, Youngstown & Ashtabula, semi-annual, 2½ per cent. on the preferred stock, payable March 28.

Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

- Allegheny Valley, annual, Pittsburgh, Pa., April 14.
- Central Ohio, annual, Columbus, O., April 23.
- Chesapeake, Ohio & Southern, annual, 56 East Court street, Memphis, Tenn., April 6.
- Chicago & Alton, annual, Chicago, Ill., April 6.
- Chicago & Grand Trunk, annual, Rialto Building, Chicago, Ill., April 8.
- Chicago, St. Louis & Pittsburgh, annual, Indianapolis, Ind., April 15.
- Chicago & West Michigan, annual, Muskegon, Mich., April 15.
- Cincinnati, Lebanon & Northern, annual, Cincinnati, O., April 14.
- Cincinnati, Richmond & Fort Wayne, annual, Richmond, Va., April 7.
- Cincinnati, Saginaw & Mackinaw, annual, Saginaw, Mich., April 21.
- Fort Worth & Rio Grande, annual, Fort Worth, Tex., April 7.
- Joliet & Chicago, annual, Chicago, Ill., April 6.
- International & Great Northern, annual, Palestine, Tex., April 6.
- Little Rock & Fort Smith, annual, Little Rock, Ark., April 30.
- Long Island, annual, Long Island City, N. Y., April 14.
- Mexican National, annual, Colorado Springs, Col., April 6.
- Morgan's Louisiana & Texas, annual, New Orleans, La., April 6.
- Morristown & Cumberland Gap, special, Morristown, Tenn., April 9, to act upon a proposed increase of capital stock.
- Newport News & Mississippi Valley, annual, New Haven, Conn., April 11.
- New York Central & Hudson River, annual, Albany, N. Y., April 15.
- New York & Long Island, special, 22 State street, New York City, April 15, to authorize an increase of the capital stock.
- Ohio Southern, annual, Springfield, O., April 20.
- Oregon & California, annual, Portland, Or., April 14.
- Oswego & Rome, special, 96 Broadway, New York City, March 28.
- Panama, annual, Mills Building, New York City, April 6.
- Pittsburgh, Cincinnati, Chicago & St. Louis, annual, 1003 Penn avenue, Pittsburgh, Pa., April 14.
- St. Louis Southwestern (Missouri), special, Room 14, Equitable Building, St. Louis, Mo., April 21.
- St. Louis Southwestern of Texas, special, Tyler, Tex., April 15.
- Southern Pacific, annual, San Francisco, Cal., April 8.
- Taylor, Bastrop & Shore, annual, Houston, Tex., March 31.
- Tennessee Coal, Iron & Railroad Co., biennial, Tracy City, Grundy County, Tenn., April 7.
- Toledo, Ann Arbor & Michigan, annual, Toledo, O., April 15.
- Unadilla Valley, special, 80 Broadway, New York City, April 15.
- Union Pacific, annual, 101 Tremont street, Boston, Mass., April 29.
- Union Pacific, Denver & Gulf, annual, Denver, Col., April 14.
- Wheeling & Lake Erie, special, Toledo, O., April 15, to vote on a proposed increase of the capital stock.

Railroad and Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The Master Car Builders' Association will hold its annual convention at the Stockton Hotel, Cape May, N. J., commencing June 9.

The New England Railroad Club meets at its rooms in the United States Hotel, Beach street, Boston, on the second Wednesday of each month, except June, July and August.

The Western Railway Club holds regular meetings on the third Tuesday in each month, except June, July and August, at the rooms of the Central Traffic Association in the Rookery Building, Chicago, at 2 p. m.

The New York Railroad Club meets at its rooms, in the Gilsey House, New York City, at 2 p. m., on the third Thursday in each month.

The Central Railway Club meets at the Hotel Iroquois, Buffalo, the fourth Wednesday of January, March, May, September and November.

The Northwest Railroad Club meets on the first Saturday of each month, except June, July and August, in the St. Paul Union Station at 7:30 p. m.

The Northwestern Track and Bridge Association meets on the Friday following the second Wednesday of each month at 7:30 p. m. in the directors' room of the St. Paul Union Station, except in the months of July and August.

The American Society of Civil Engineers holds its regular meetings on the first and third Wednesday in each month, at the House of the Society, 127 East Twenty-third street, New York. The annual convention will be held at Lookout Mountain, Tenn., commencing about May 30.

The Boston Society of Civil Engineers holds its regular meetings at the American House, Boston, at 7:30 p. m., on the third Wednesday in each month.

The Western Society of Engineers holds its regular meetings at 78 La Salle street, Chicago, at 8 p. m., on the first Wednesday in each month.

The Engineers' Club of St. Louis holds regular meetings in the club's room, Laclede Building, corner Fourth and Olive streets, St. Louis, on the first and third Wednesdays in each month.

The Engineers' Club of Philadelphia holds regular meetings at the House of the Club, 1122 Girard street, Philadelphia, on the first and third Saturday, of each month, excepting in January, when the annual meeting is held on the second Saturday of the month. The second January meeting is held on the third Saturday. The club stands adjourned during the months of July, August and September.

The Engineers' Society of Western Pennsylvania holds regular meetings on the third Tuesday in each month, at 7:30 p. m., at its rooms in the Penn Building, Pittsburgh, Pa.

The Engineers' Club of Cincinnati holds its regular meetings at 8 p. m. on the third Thursday of each month in the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati.

The Civil Engineers' Club of Cleveland holds regular meetings on the second Tuesday of each month, at 8:00 p. m., in the Case Library Building, Cleveland. Semi-monthly meetings are held on the fourth Tuesday of the month.

The Engineers' Club of Kansas City meets in Room 200, Baird Building, Kansas City, Mo., on the second Monday in each month.

The Engineering Association of the South holds its monthly meetings on the second Thursdays at 8:00 p. m. The Association headquarters are at Nos. 63 and 64 Baxter Court, Nashville, Tenn.

The Denver Society of Civil Engineers and Architects holds regular meetings at 36 Jacobson Block, Denver, on the second and fourth Tuesday of each month, at 8 o'clock p. m., except during June, July and August, when they are held on the second Tuesday only.

The Civil Engineers' Society of St. Paul meets at St. Paul, Minn., on the first Monday in each month.

The Montana Society of Civil Engineers meets at Helena, Mont., at 7:30 p. m., on the third Saturday in each month.

The Civil Engineers' Association of Kansas holds regular meetings at Wichita on the second Wednesday of each month, at 7:30 p. m.

The American Society of Swedish Engineers holds meetings at the club house, 250 Union street, Brooklyn, N. Y., and at 347 North Ninth street, Philadelphia, on the first Saturday of each month.

The Engineers' Club of Minneapolis meets the first Thursday of each month in the Public Library Building, Minneapolis, Minn.

Boston Society of Civil Engineers.

The society held its annual meeting at the American House, Boston, March 18, President Clemens Herschel in the chair and 82 members and visitors present. The annual report of the Board of Government showed the society to have had a very prosperous year. Its total membership is now 265, and 55 have joined during the past year. The financial statement showed a gain of over \$600 in the funds of the society. Reports were received from the several special committees.

The Committee on Permanent Headquarters recommended that the society, either in its own name or by a majority of its members as stockholders, should secure a proper and suitable headquarters without further delay. The report recommends procuring premises costing from \$20,000 to \$30,000.

The Secretary read a communication from Col. E. D. Meier, of St. Louis, Secretary of the Eads Monument Association, in relation to erecting a monument to the late James B. Eads. A vote was passed expressing the desire of the Society to join in the undertaking and the Secretary was authorized to receive subscriptions for that purpose.

The result of the election for officers was as follows: President, Frederic P. Stearns; Vice-President (for two years), Wm. E. McClintock; Secretary, S. Everett Tinkham; Treasurer, Henry Manley; Librarian, Frank W. Hodgdon; and Director (for two years), George F. Swain.

The retiring President, Clemens Herschel, delivered a very interesting and carefully prepared address "On the Advancement of the Profession of the Civil Engineer."

Engineers' Club of Philadelphia.

A business meeting was held March 7, President Wilfred Lewis in the chair and 38 members present. The Chairman of the Tellers of Election reported that 108 votes had been cast for the new constitution and by-laws, and 7 against. They were therefore adopted.

The Secretary presented for Mr. J. J. Hoopes notes on the Mississippi River Discharge, and also for Mr. C. B. Hunt notes on Street Cleaning in Washington, D. C. There was some discussion by Messrs. E. V. d'Inville and Rudolph Hering, and, on motion of Mr. J. C. Trautwine, Jr., the subject of Street Cleaning on Asphaltum

and other smooth pavements was referred to a committee to report as to the practice in this matter in various important cities.

The Secretary presented for Mr. Howard Constable a description of the Re-enforcement of Foundation in a Drawbridge Pier.

Mr. Rudolph Hering continued reading a paper on the Corrosion of Iron and Steel, and referred to galvanic action as a principal cause. He gave the results of experiments on this subject, and principally of those made by Mr. Thos. Andrews, of England. Wrought iron was placed in connection with numerous steels and cast iron, and exposed to sea water for about 300 days. From these it was found that metals corroded much faster when in galvanic connection than otherwise. The wrought iron (Wortley best scrap) resisted corrosion better than either steel or cast iron. The electro-chemical position of the steel changed frequently with reference to wrought iron, indicating that corrosion took place alternately in the wrought iron and steel. The position was almost constant, however, when connecting wrought and cast iron, indicating corrosion to take place almost entirely in the latter. Gravimetric results were also given, which showed the amount of corrosion in grains per square foot per annum under the conditions assumed in the experiments.

Master Mechanics' Association.

The committee to report at the next annual meeting of the association upon the best means of purification or softening of feed water desires to procure all the information possible on this subject, under the following heads:

(1) Have you had any experience with mechanic devices? If so, with what result?

(2) Have you tried chemicals, and with what result?

(3) Have you found practical, and do you recommend for use, any of the mechanical or chemical devices for purifying water? Please tell briefly what your experience has been with any method that you have tried, and also make any suggestions or recommendations that will be of use to the committee.

The committee would call your attention to the fact that no report has been presented to the association (though a committee has been in existence) for the last three years, and that it is very desirable that the subject be adequately covered this year.

Replies to be sent to W. T. Small, 749 Dayton avenue, St. Paul, Minn.

The committee appointed to investigate the subject of "Examination of Locomotive Engineers and Firemen, on their duties relating to the use of fuel, care of the locomotive, and ability to deal with disorder or disability of machinery, to what extent practiced, and best plan for conducting the examination," request answers to the following questions:

(1) Do you examine engineers employed from other roads on anything except time card rules? If so, what plan do you pursue and of what does the examination consist?

(2) Do you examine firemen, candidates for promotion? and, if so, what line of examination is followed?

(3) In hiring men for firemen, what age do you consider the limit past the age of 21 years?

(4) Do you advise that the first year in service, as fireman, be on a switch engine?

(5) What do you consider the shortest time a fireman should serve in that branch of service before he is allowed examination for promotion to engineer? If a fireman fails in an examination, how do you deal with him?

New York Railroad Club.

At the next regular meeting of the New York Railroad Club, the third Thursday in April, the special business will be a discussion of changes in the Rules of Interchange. Suggestions from the club on this subject are requested by the Arbitration Committee of the Master Car Builders' Association.

Virginia Engineers.

A meeting will be held at Roanoke, Va., at noon, April 4, to organize a state association of engineers. The association will include "civil, mechanical, mining and electrical engineers, architects, geologists and others who have shown themselves proficient engineers in practice or teaching." Correspondence on the subject should be addressed to Mr. W. E. Anderson, Chairman of the Committee, post-office box 157, Roanoke, Va.

PERSONAL.

—Mr. W. J. Murphy is now connected with the East Tennessee, Virginia & Georgia, as Superintendent of the Brunswick Division.

—Mr. H. E. Chamberlin, formerly General Traffic Manager of the Concord & Montreal, with his wife, are to sail for Europe March 29.

—Major Hamilton Wilkins, President and General Manager of the Augusta, Gibson & Sandersville, has been appointed Superintendent of Repairs of the Covington & Macon for the Richmond & Danville. Mr. Wilkins will still retain his offices on the Augusta, Gibson & Sandersville.

—Mr. Wistar Morris, senior partner of the iron firm of Morris, Tasker & Co., of Philadelphia, and one of the Directors of the Pennsylvania Railroad, died March 24 at his residence at Overbrook, after one week's illness. He was 75 years old, and in length of service was the oldest director of the Pennsylvania.

—Mr. W. M. Mitchell, a conductor in the employ of the Atchison, Topeka & Santa Fe, has been elected Railroad Commissioner of Kansas by the Executive Council to succeed Judge James Humphrey. He has been working on railroads for 20 years as brakeman, fireman, station agent and conductor.

—Mr. George Woods, who succeeds the late Mr. Wistar Morris as a director of the Pennsylvania, is a member of the firms of R. D. Wood & Co. and R. D. Wood & Sons. He is an active business man, and is identified with the Pennsylvania Railroad interests, being a director also of the West Jersey road and President of the West Jersey & Atlantic. He is also President of the Manufacturers' Mutual Fire Insurance Co., of Philadelphia.

—Mr. Levi C. Wade, President of the Mexican Central for the last six years, died last week at his home at Newton, Mass., near Boston. Mr. Wade was 49 years old, and was a lawyer by profession. He was admitted to the bar in 1874 and in 1880 took up railroad law, to which he confined his attention almost exclusively. Mr. Wade was counsel for the Atchison, Topeka & Santa Fe, the Atlantic & Pacific, the Sonora Railroad, and the Mexican Central. He was a director of the Mexican Central,

Cincinnati, Sandusky & Cleveland, and Atlantic & Pacific roads.

—Mr. Virgil Powers, of the Southern Railway & Steamship Association, has been appointed Railroad Commissioner of Georgia. He succeeds Col. J. W. Robertson, who resigned last January. Mr. Powers was Commissioner of the Southern Railway and Steamship Association for the 12 years prior to 1888, when he became Consulting Commissioner. He is now nearly 72 years old, and for 46 years has been connected with railroad service. Between 1834 and 1847 he was on the Central of Georgia; for six years he was Principal Assistant Engineer on the Southwestern, and then went back to the Central as Chief Engineer until 1858, and then served as Superintendent until 1876.

—Mr. James A. Rumrill, Vice-President and Secretary of the Boston & Albany, has resigned, and will go to Europe for a rest. He retains his place as director, but in consequence of impairment of health and his numerous other engagements feels compelled to give up his active duties in the service of the road. Mr. Rumrill entered the service of the Western road in 1865, and has been identified with the legal department of that company and its successor ever since. He has been vice-president since 1890. In talking with a reporter Mr. Rumrill said: "The only perplexing and difficult duties that have fallen to my lot have been those growing out of the claims and demands made upon the company for damage to person and property. With the constantly enlarging scope of the old common law liability of carriers, both to passengers and employees, an officer vested with certain discretionary powers over funds not his own and which he is bound to protect, and with a heart alive to the misfortunes that unavoidably result from the hazardous nature of railroad business, has a task to perform, the difficulties of which are only known to those who are constantly engaged in it. To play the part of a conscientious trustee, and a sympathizer with human suffering at one and the same time, is oftentimes a great strain upon a man's physical and mental powers." Mr. Rumrill has fulfilled this double duty with marked ability, his character and temperament being such that he always gave due weight to the last half of it.

ELECTIONS AND APPOINTMENTS.

Bangor & Piscataquis.—At the annual meeting recently held in Bangor, Me., Joseph W. Porter was chosen director in place of N. C. Ayer, resigned, and the old officers were re-elected as follows: President, E. B. Neally; Treasurer, H. W. Blood, and Superintendent, Arthur Brown.

Bergen Neck.—The directors and officers of this New Jersey road are: J. D. Potts, C. A. Sterling, T. H. Wheeler, J. H. Archbold, J. A. Hand, C. M. Johnson and H. H. Rogers, Directors. President, Charles A. Sterling; Secretary, J. A. Hand; Treasurer, Charles M. Johnson, and Chief Engineer, F. M. Slater.

Charleston, Cincinnati & Chicago.—The receiver has appointed the following officers: C. M. Ward, General Manager, in place of J. F. Jones; S. B. Pickens, General Freight and Passenger Agent; W. E. Stoney, Auditor, in place of J. J. Collier, Comptroller. The headquarters of the officers will be in Charleston, S. C. A. Tripp has been appointed Superintendent, with headquarters at Blacksburg, S. C.

Eastern Central.—The stockholders met in Galion, O., March 18, and elected the following officers: President, Col. John Lee, Crawfordsville, Ind.; Vice-President, H. C. Carhart, Galion; Treasurer, M. Deal, Bucyrus, and Secretary, Jacob Riblet, Galion. Directors: John Lee, Isaac Elston, M. Deal, H. C. Carhart, A. C. Squier, F. A. Keen and Jacob Riblet.

East Tennessee, Virginia & Georgia.—E. H. Barnes having resigned as Superintendent of the Georgia Division, W. R. Beauprie has been appointed Superintendent of the line between Cleveland and Macon, including the Decatur branch. This will be known as the Atlanta Division, with headquarters at Atlanta, Ga. W. J. Murphy has been appointed Superintendent of the line between Macon and Brunswick, including the Hawkinsville branch. This will be known as the Brunswick Division, with headquarters at Macon, Ga.

Esanaba, Iron Mountain & Western.—The new directors of the road are: F. Lynde Stetson, President; George H. Kent, Leslie Ryan and Byron L. Smith. These represent the syndicate which recently purchased the road from the Schlesingers.

Fort Scott, Kansas City & Northern.—The following officers were elected at a meeting in Fort Scott, Kan., March 18: A. A. Harris, President; John Crow, Vice-President; J. P. Chennault, Treasurer, and S. P. Mosher, Secretary.

Kentucky Central.—The new Board of Directors, elected at Cincinnati, O., last week, are: H. E. Huntington, Cincinnati; M. H. Smith, Louisville; Eckstein Norton, William Martin, J. A. Horsey, J. D. Probst and Thomas Ritter, New York.

Mayville & Lexington.—The stockholders of this division of the Kentucky Central met in Cincinnati, O., last week and elected M. H. Smith, H. W. Bruce, C. Quarrier, Louis Wood, Brent Arnold, C. R. Brent and J. W. Ellis, as directors. M. H. Smith was elected President, and J. W. Ellis, Secretary.

Mexican National.—A meeting of the bondholders was held in New York City under the provisions of the voting trust agreement dated Sept. 1, 1887. The following named gentlemen were nominated for Directors to be voted for by the voting trustees at the annual election in Colorado on April 6: William G. Raoul, Josiah A. Horsey, Charles C. Beaman, Eckstein Norton, William Mertens, and Gustav J. Wetzel. For nominees resident in Mexico, Emilio Velasco and William Landa.

Oregon Short Line & Utah Northern.—At the annual meeting of the stockholders held in Salt Lake City, Utah, March 18, F. L. Ames, E. F. Atkins, F. Gordon Dexter, Boston; John Sharp, Salt Lake City; Sidney Dillon, A. H. Green, Jay Gould and Russell Sage, New York, and S. H. H. Clark, Omaha, were elected directors. The last three named were elected in place of C. F. Adams, D. B. Thomson and W. H. Holcomb.

Ottawa & Arnprior.—The following directors have been elected for the current year: R. Booth, Claude McLachlin, Chairman; Neil McIntosh, Charles Mohr, E. J. Chamberlain, C. J. Booth, J. F. Booth, Wm. Anderson and A. W. Fleck, Secretary.

Pennsylvania.—R. L. Holliday, who has been Superintendent of the Central Division, with headquarters at

Media, Pa., since June last, has been transferred now to the Delaware Division. His headquarters will be at Clayton, Del.

The following directors were elected this week: George B. Roberts, Alexander M. Fox, Alexander Biddle, N. Parker Shortridge, Henry D. Welsh, William L. Elkins, H. H. Houston, A. J. Cassatt, C. A. Griscom, B. B. Comegys, Amos R. Little, William H. Barnes and George Wood. Mr. Wood takes the place of the late Wistar Morris. The directors met for organization March 25. The present officers were re-elected as follows: President, George B. Roberts; First Vice-President, Frank Thomson; Second Vice-President, J. N. Dubarry; Third Vice-President, John P. Green; Secretary, John C. Sims, Jr.; Treasurer, Robert W. Smith.

River Front.—The stockholders of the company this week elected the following Directors: J. N. Du Barry, President; George B. Roberts, N. P. Shortridge, Henry D. Welsh, Frank Thomson, John P. Green, H. H. Houston, Amos R. Little and H. H. Barnes.

Springfield, Sedalia, Marshall & Northern.—At a meeting of the stockholders in Sedalia, Mo., March 19, W. L. Porter, W. H. Powell, Jr., and R. H. Moses, of that town, were elected directors.

Suburban.—E. E. Pratt, Francis Peabody, Jr., R. E. Robbins, F. V. Parker and John Bryant are the incorporators of this Massachusetts company.

Union Pacific.—G. O'Neill has been appointed Assistant Superintendent of the Wyoming division with headquarters at Evanston, Wyo., and jurisdiction west of Granger.

Watauga Valley.—The stockholders of the company met at Knoxville recently and elected the following officers: President, G. C. Potts, South Watauga, Tenn.; Vice-President, H. S. Chase, Boston; Treasurer, W. T. Robinson, Knoxville, Tenn.; Secretary, J. W. Caldwell, Knoxville; Directors, C. H. Nimson, Cranberry, N. C.; G. C. Potts, South Watauga, Tenn.; Ed Fitzgerald and F. K. Huger, Knoxville; J. W. Hollman, Philadelphia; H. S. Chase, Boston; G. T. Thompson, Philadelphia.

RAILROAD CONSTRUCTION.

Incorporations, Surveys, Etc.

Alabama Grand Trunk.—The charter of the Montgomery & Sylacauga has been amended and the company has been reorganized under the above name. The road is projected to extend from Montgomery north to Sylacauga, a distance of about 60 miles. Surveys will probably also be made north to the Coosa River in St. Clair or Cherokee counties.

Alabama Midland.—Grading is soon to be resumed on the Rutledge and Julian branch, which was partly graded last year between Rutledge on the main line and Julian, Ala. The distance is about four miles. The claims of J. W. Pruitt & Co., the former contractors, have been settled and the contract for the balance of the work will probably be let to a new firm shortly.

Atlantic & Northwestern.—A charter for this company was granted at the recent session of the Georgia legislature. The Piedmont Construction Co., which was recently organized at Athens, Ga., proposes to construct the road. Surveys have been made along the route of the proposed extension of the Augusta & Chattanooga from Augusta northwest through Washington and Athens as far as Gainesville. The surveys will be continued beyond Gainesville toward Chattanooga. The officers claim that the new surveys will give a route between Augusta and Chattanooga about 60 miles shorter than by the surveys made by the Augusta & Chattanooga. The line from Augusta to Gainesville will probably be 130 miles long and will be north of the line of the Georgia road, which is 170 miles long between the two points. The projectors have asked that \$250,000 of the first mortgage bonds of the company be subscribed by the city of Augusta. R. M. Mitchell, of Augusta, is President, and Allen D. Candler, of Gainesville, Ga., the Secretary of the Piedmont Construction Co.

Barberton Belt Line.—A company of this name filed articles with the Secretary of State of Ohio last week to build a belt line at Barberton. The capital stock is \$50,000.

Bergen Neck.—The National Storage Co. over a year ago projected a road to start from its docks and property on New York harbor, south of the Central of New Jersey docks in Jersey City, and extend through Bayonne to the southern end of the Jersey peninsula. The road is now about graded from a point 200 ft. southeast of the tracks of the Central of New Jersey in Jersey City southeasterly through Bayonne, and thence across the cove of New York Bay to Van Buskirk's Point and to the Kill von Kull near the Orford Copper & Sulphur Co.'s works. The track in Jersey City begins about 1,400 ft. southwest of Communipaw avenue and extends parallel to the Central of New Jersey, on the east, through Bayonne. There is a girder bridge across Morris Canal, built by the Philadelphia Bridge Works, of Pottstown, Pa. The maximum grades are one-half of one per cent, and the curvature seven degrees. The National Storage Co. is also building a branch about 1½ miles long, called the Kill von Kull, which leaves the Bergen Neck line at the foot of East Thirtieth street, Bayonne, and extends to a point just west of the Ocean Oil Co.'s works on the Kill von Kull. The length of the main line of the Bergen Neck is 5½ miles, and for several miles of this distance the route is across the streets and avenues of the towns, and for much of the balance through a thickly settled country. Many injunctions have been obtained by private property-holders restraining the construction of the road, and the work has been considerably hindered by the opposition of the towns and railroads. These and other causes have made the progress of the work very slow.

Birmingham, Sheffield & Tennessee River.—A survey is reported to have been made recently by this company for a proposed branch from Sheffield to Morgan, Ala., to connect with its proposed branch from the Memphis & Charleston road to Riverton. The new line will complete a route between Sheffield and Riverton.

Cambridge & Chesapeake.—The proposed road from Cambridge to Fox Creek in the lower part of Dorchester County, Md., will probably be incorporated under this title.

Canadian Roads.—Application is being made to the Dominion parliament for power to build a line from the village of Brighton, Northumberland County, Ont., to a point on the Ontario & Quebec road, near Norwood,

Peterborough County, thence in a northerly direction through the districts of Haliburton and Nipissing, Ont., to connect with the Canadian Pacific.

Cerdan Valley.—This company operates a short road through the Cerdan Valley, south of the City of Mexico, and recently surveys have been made to extend its rapid transit lines through the principal streets of the capital. The branches in the City of Mexico will probably be seven miles long.

Chattanooga Southern.—Work is soon to begin on an extension from a point south of Gadsden, Ala., the present terminus of the main line, to a connection with the East & West Alabama, a distance of 15 miles. The company expects to run trains through Gadsden into Birmingham, using the tracks of the East & West Alabama from its junction with that line to Pell City, and the Georgia Pacific from that point to Birmingham. The main line from Chattanooga to Gadsden, 96 miles, will be completed early in May. The Alabama Great Southern is practically paralleled between these two points, and if the Chattanooga Southern runs its trains into Birmingham as it expects, the competition between the two roads will be extended to that point, as the Alabama Great Southern runs to Birmingham from Gadsden.

Chesapeake & Ohio.—The contractors who are building the Hot Springs branch have about 1,000 men at work on the grading, and expect to commence the tracklaying about May 1. The road is being built from the main line at Covington north to Hot Springs, Va., a distance of 24 miles. The contract for constructing the branch has been let to Gooch, Rinehart, Carpenter & Co. and W. P. Chapman & Co.

Besides this line the Craig Valley branch will also probably be completed early in May. The grading is now nearly finished. This branch is 27 miles long, and extends from Bessemer, near Eagle Rock, on the James River Division, to Newcastle, Va.

Chicago & Eastern Illinois.—The surveyors for the line to the Ohio River reached Blue Lick, Ill., last week. That is a point in the Silver Hills in Clark County, about 14 miles north of Jeffersonville. No further work is proposed on the line, other than this survey, and it is doubtful if any part of it is built.

Chicago, Kansas City & Texas.—The tracklaying on the extension from Smithville, the present terminus, 22 miles north of Kansas City, will probably be commenced next week. The grading has been completed to Gower, Mo., a distance of 16 miles, making the total length of the road 28 miles. The road has been surveyed for some distance north of Gower, but it is not proposed to build beyond that town at the present time. The extension will pass through Carpenter's Store, Clinton County; thence north, crossing the Chicago, Rock Island & Pacific at Culver, a mile west of Grayson, and to Gower from this point the trains will use the tracks of the Atchison, Topeka & Santa Fe to St. Joseph, a distance of about 20 miles.

Chicago, Rock Island & Pacific.—A Chicago newspaper says that an ordinance will soon be introduced in the Chicago City Council permitting the company to build a six-track elevated road over its present right-of-way from its city station to Engelwood, to be used for the passenger service of that road and the Lake Shore & Michigan Southern.

Cleveland, Wooster & Western.—An arrangement was made last fall that a branch of the Akron & Chicago Junction road should be built from Lodi or Burbank south to Wooster, O., a distance of 20 miles. There is an uncompleted grade made by another company between the points, which is to be used as part of the new line. Several liens on it are to be taken up by the town of Wooster, and the grade will then be transferred to the contractors of the new branch, Ryan & McDonald, of Baltimore. The contractors agree to have the road finished by Oct. 1 next. The final arrangements in regard to the disposition of the roadbed and the claims against the old company, which amount to about \$17,000, were only settled last week. Pending the settlement, the contractors delayed commencing the grading.

Delaware & Eastern.—This company has been recently organized at Delaware, O., to build a road through Delaware and Knox counties from the town of Delaware easterly to Centreburg. The length of the proposed line is 22 miles, and nearly all the grading was done some years ago and some of the bridges built by the Springfield, Mt. Vernon & Delaware, which failed to complete the road. It is estimated that it will cost \$150,000 to repair the old grade and to lay the track. The franchise of the old road is owned by the Cleveland, Akron & Columbus, and that company will probably operate the new line between Delaware and Centreburg, if the counties subscribe the amount needed to repair the grade. The incorporators are D. Paul, of Centreburg; V. T. Hills, V. D. Stayman, E. H. Hyatt and W. Perfect, of Delaware.

Delaware, Susquehanna & Schuylkill.—The contract for grading about 14 miles on a branch from Hazleton, Pa., has been let to W. E. Hawley & Co., of Pittsburgh, Pa.

Eastern Central.—New officers were elected at a meeting at Galion, O., and they propose to resume the construction of the line immediately. They state that the grading will be begun at Galion, and continue easterly toward the coal fields in Holmes County. Part of the right of way has been secured. The office of the President, Col. John Lee, will be at Galion during the building of the line.

Fort Scott, Kansas City & Northern.—The organization of the company was completed at a meeting at Fort Scott, Kan., last week. The surveys are to be made at once from Fort Scott northeast to Amoret, Mo., on the Kansas City, Nevada & Fort Smith, a distance of about 27 miles. The grading will probably be commenced later in the summer.

Fort Worth & Rio Grande.—A branch is said to be projected from Stephenville on the line south of Granbury, Tex., up the Bosque Valley to the mines of the Texas & Pacific Coal Co., near Thurber, in Erath County.

Helenwood & Middlesborough.—This company has been recently chartered by Ridgeway, Franklin & Co., of Helenwood, Tenn., to build a road from Helenwood, on the Cincinnati Southern, northeasterly to Middlesborough, Ky. The distance between these points is about 50 miles. None of the surveys have yet been made, but it is expected that the engineers will commence running the lines about April 1.

Louisville, Madison & Cincinnati.—A survey is now being made for a line from the Ohio River at

Madison, in Jefferson County, Ind., north through Jefferson and Ripley counties to a point on the Ohio & Mississippi, about 25 miles. The projectors have asked Ripley County to vote a two per cent. subsidy and to secure the right of way. J. C. Fawcett, of Louisville, is President.

Memphis, Rogers & Western.—W. H. Hilliard is the Engineer in charge of the survey just begun for this road between Rogers and Bald Knob, Ark. The survey is being made for the Rogers Chamber of Commerce. That organization has also secured the charter of the company.

Middlesborough Belt.—McFarland, Walton & Co., of Knoxville, Tenn., are the contractors on the extension of the belt line which was recently put under contract. The work is to be on Bennett, Stony and New Cabin creeks, and the new track to be laid on these creeks will probably aggregate nine miles.

Mississippi River & Bonne Terre.—Surveys have been made for a projected extension from Bonne Terre south through the Flat River mining district to Doe Run, Mo. The distance is about 15 miles, and the locating surveys have been made on about half the distance to Flat River. The right of way has been secured for nearly the entire distance.

Missouri Pacific.—Material for completing the Plattsmouth extension, near Omaha, will soon be delivered, and Vice-President Clark states that it is the intention of the company to finish the line as soon as the weather becomes favorable for construction work.

Mt. Carmel & Natalie.—A charter was granted to this company in Pennsylvania last week. The capital stock is \$175,000, and it is proposed to build a road six miles long between Mt. Carmel and Natalie, Pa., connecting with the Philadelphia & Reading at the former town. The road will be built by the Penn Anthracite Coal Co., which owns anthracite coal mines at Natalie. That company has made a contract with the Philadelphia & Reading to mine at least 500,000 tons of coal annually, to be transported over the Reading lines from Mt. Carmel. It is said that most of the coal is to be transported to New England over the Pennsylvania, Poughkeepsie & Boston and the Poughkeepsie Bridge route.

Mount Tabor & Eastern.—The company has been formed in Oregon to construct a road from Portland easterly toward the Cascade Mountains. Its capital stock is fixed at \$250,000. J. T. Ross, B. Lamberson, L. W. Wallace, George W. McCoy and J. D. Hart are incorporators.

New Orleans & Northwestern.—A. Heffner, of Oak Ridge, La., is the contractor for grading the extension from the present end of track at Rayville, on the Vicksburg, Shreveport & Pacific, northwesterly to Oak Ridge, La. The extension is about 20 miles long, and gives the road a connection with the Houston, Central Arkansas & Northern at a point a few miles southeast of Bastrop.

New Roads.—S. A. Jones, of Tampa, Fla., is one of the projectors of a road to extend from Tampa, Fla., northwest along the shore of Old Tampa Bay to the Anclote River, near the Anclote Islands, off the westerly coast of Florida. The road will probably be about 20 miles long.

The Tacoma Mining & Milling Co. has made surveys for a road from the mouth of Blue River, near Eugene, Or., to a point known as Gold's Hill, where the mines of the company are situated. The line will probably be 7½ miles long, and will have an elevation of 2,800 ft. in this distance. The board of trade of Eugene has been asked to aid in the construction of the line and secure part of the right of way.

R. K. Warren, of Mobile, Ala., President of the Mobile Transportation Co., has asked the county commissioners to grant that company the right of way over the county roads from Mobile, south along the western shore of Mobile Bay, for a road which the company proposes to build to Portersville, 20 miles south of Mobile. The line may also be extended to other towns further south.

L. R. Benjamin, of Alexandria, Tenn., is interested in a road which is to extend from Alexandria to a connection with the Nashville & Knoxville, a distance of about 2½ miles.

A company has been formed at Port Angeles, Wash., to build a road from that town southeast to Junction City, at the head of Discovery Bay, near Port Discovery. The line is about 25 miles long and a connection will be made at its eastern end, a few miles south of Port Townsend, with the Port Townsend Southern. The survey for the line is now in progress.

A. C. Cleveland, T. R. Hofer and others have incorporated a company in Nevada which proposes to construct a line from Reno easterly through the state. The capital stock is \$40,000.

At Pueblo a charter is being drawn for a road about 70 miles long, to extend from Trinidad north through Apishapa and Walsenburg, and thence northeasterly along the Apishapa River to Rocky Ford.

Albert E. Boone, of Zanesville, O., of the Black Diamond projects, has induced the Bay City common council to promise to secure the right of way from Bay City, Mich., to the county line, for a road to the Sebawaing coal fields, via Cairo and Wilmet. The sum of \$25,000 will also be granted when the road is built, and \$25,000 if it is extended to Port Huron.

A preliminary survey has been begun on the proposed road from Globe, at a point on the Oregon side of the Columbia opposite Kalama, to Astoria, Wash. The length of the road will be 50 miles. The citizens of Astoria are the principal projectors of the enterprise.

Northern Pacific.—The second track is now being built between Puyallup and Meeker, Wash. The work is very nearly completed between these points, and when the track has been laid it is expected that the work will be commenced between Tacoma and Puyallup, a distance of about nine miles. The grading will be very expensive on this last section, and it is estimated that it will cost nearly \$250,000 to complete the work. The country is now very swampy and the grading may be delayed some weeks until the ground becomes dry.

Northern Pacific.—The company which controls the Chicago terminals of this line has arranged for the immediate construction of an extension from Blue Island to Harvey, Ill., connecting with the Chicago Central and Calumet Terminal lines at Blue Island. The right of way is practically parallel to the Grand Trunk tracks.

North Mexican Pacific.—When the concessions of the Deming, Sierra Madre and Pacific, and the Chihuahua, Sonora & Sinaloa, were purchased by John W. Young, of Salt Lake City, the reorganization was partly effected under the title of the Mexican Pacific. It has been found that that name is already used by a Mexican

company, and it has been decided to adopt the North Mexican Pacific as the corporate title of the new line. The route for the road as at present located is from Deming by Palomas, Colonia Diaz, Colonia Juarez, Guerrero to Topolobampo and from Topolobampo along the Pacific coast to Guaymas, with a branch to the coal fields northeast of that town, and also a branch from the city of Chihuahua to Guerrero, intersecting the main line there. Concessions from the Mexican government have been secured by the new company. It is expected that contractors will begin work in Mexico in a few weeks, and the grading will then be pushed rapidly. The road will open up a large extent of arable land well suited for cultivation. The promoters have already arranged to send several colonies of immigrants into the country. There will probably be about thirty or forty thousand of Utah people who will emigrate to Mexico from settlements in the territory where the land has become occupied.

Orange-Keysville.—There is said to be some prospect that work will be resumed on this road at an early date. The line, as projected, is to extend from Keysville, via Hampton Sidney College, Farmville and Arvon, to Gordonsville, Va. It will be about 100 miles in length. The preliminary surveys have been made from Keysville to Arvon, 50 miles, and 30 miles of this distance is already located. The grading is practically completed on 20 miles. When completed, the road will open up a fine section of the country, rich in minerals and timber. Maj. John Goodwin is President and W. A. Dafter is Secretary and Chief Engineer. The office is at Farmville, Va.

Ottawa & Arnprior.—At a meeting of the shareholders of the company held last week it was decided to apply to the Ontario Legislature for an act giving it power to amalgamate with the Ottawa & Parry Sound road and to increase the company's bonding power to \$25,000 per mile.

Ottawa & Gatineau Valley.—Rails are now laid to Peche village, 18 miles, and will be immediately laid two miles further to complete the second 10 miles. As soon as this is done a government inspection will take place. The bridge across the Peche River will be finished in two weeks. It is a steel girder bridge, with one span of 80 ft. The third section of the road, from the Peche to Stage Creek, 10 miles, will be finished soon and the whole 30 miles will be in operation by the end of the present year. It is expected the road will be ballasted and passenger trains running to Chelsea by July and to the Peche River in August.

Pennsylvania.—The engineers of the West Jersey road began a survey last week for a short branch between Sea Isle City and Avalon, through Brewster avenue. The branch will be about four miles long and the cost is estimated at \$20,000. Two long bridges are to be built, but it is expected that the line will be in operation this summer before the seaside travel is inaugurated.

Pennsylvania & Northwestern.—Contracts are reported to have been let for building a second track on the southern part of the line from Lloydsville, Pa., near Bellwood, to Irvona, a distance of about 17 miles. It is said that the old line between these points may be abandoned when the new road is ready for operation.

Pittsburgh, Shenango & Lake Erie.—The route of the extension through Erie, Pa., is being relocated, and this work has considerably delayed the completion of the extension to Lake Erie. The Pennsylvania objected to the former route through Erie, claiming to have prior rights of way for tracks over some of the streets which the city council authorized the new road to occupy.

Pittsburgh & Western.—At a meeting of the directors in Allegheny, Pa., last Saturday it was voted to issue \$2,000,000 of new bonds to complete various improvements on the line. A meeting of the stockholders will be held May 21 to confirm the action of the directors.

Plymouth & Middleboro.—The Old Colony is said to have agreed to subscribe for a large portion of the stock of this company and to operate the road when it is completed from Plymouth on its Central Division west to Middleboro, Mass., on the Cape Cod Division, about 15 miles. In addition to the stock subscribed by the Old Colony, and the \$60,000 subscribed by the two towns which the road is to connect, it is expected that \$20,000 will be voted along the route.

Quebec Central.—The shareholders of this road will meet in London May 5 to consider the proposal to construct the proposed line between Beauce Junction and Tring Station, Que., on the Atlantic & Northwestern road, which has already been surveyed to near the Maine state line.

Queenstown & Niagara.—This company is applying to the Dominion Parliament for power to construct a bridge across the Niagara River at Queenstown, and to build a road between Niagara Falls, Queenstown and St. Catharines, Ont.

Red River & Southwestern.—The preliminary survey has been completed from Henrietta, on the Missouri, Kansas & Texas, southwest to Archer, Tex., a distance of about 20 miles. The locating survey has been made for about the distance from Henrietta by Major Walhan, the chief engineer. He will probably let contracts at Henrietta this month for the grading on the first section.

Roanoke & Southern.—The bridge over the Smith River has been completed, and now that that work will not hinder the construction forces the company will be able to run regular trains from Winston to Martinsville, Va., about April 15.

St. Catharines & Niagara Central.—This company is applying to the Dominion Parliament for an act to increase its bonding power from \$20,000 to \$30,000 per mile; also for power to build the road across the Niagara River at the Falls, or to connect with a road in the state of New York.

Shuswap & Okanagan.—The contract is reported to have been recently let for an extension from the foot of Okanagan lake south to the international boundary line in British Columbia. The distance is about 45 miles. The grading will probably be commenced in a short time and the road will be ready for operation by Aug. 1. It is now in operation from Shuswap Lake at Sicamous, B. C., on the Canadian Pacific, south to the head of Okanagan Lake. This lake is about 70 miles long, and for the present the southern and northern divisions of the road will be connected by steamers run on the lake.

Southern Pacific.—The track on the extension of the San Joaquin Valley Division from Los Banos, Cal., south

to the Goshen Division, is now completed to a point near the north bank of the Kings River, about nine miles north of Armona. The track is being laid north from the latter point, which will be the terminus of the extension for some time. Trains will probably be running on the entire division by the end of April.

A press dispatch states that it is proposed to abandon the present route at Yuma, Ariz., on account of the heavy floods which often occur at that point, washing away the track. A new line will be built on higher ground north of the town.

Stoneham.—The committee appointed by the board of trade of Stoneham, Mass., has reported to that body that the Boston & Maine will agree to operate a road between Stoneham and Middlesex Falls, on the main line of the western division, if \$50,000 is subscribed by Stoneham. The line will be 3½ miles long and will lessen the distance to Boston to 8½ miles. It is expected that the cost of building the double track road which is proposed will be \$200,000.

Waynesburg & Washington.—A preliminary survey was commenced last week for a proposed extension from Waynesburg southeast to Mt. Morris, a distance of about 15 miles. The line follows Smith Creek part of the distance. The survey will probably be continued beyond Mt. Morris to a connection with the Baltimore & Ohio, near Morgantown, W. Va.

Western New York & Pennsylvania.—The company is said to have decided to begin grading at once on the proposed line between Oil City and Stoneboro, Pa., for which surveys have been recently made. The new line will extend from the present road between Stoneboro and Mercer and near Jackson Centre, northeasterly to Polk in Venango County, and thence through Franklin to Oil City, paralleling the Lake Shore & Michigan Southern from Polk. The New Castle division has been separated from the main line through the refusal of the Lake Shore & Michigan Southern to renew the trackage agreement by which this road formerly ran its trains on 30 miles of the Lake Shore's leased line, the Jamestown & Franklin, between Stoneboro and Franklin.

West Virginia Central & Pittsburgh.—The grading has been commenced on the extension from Elkins southwest to Beverly, W. Va., via the Tygart Valley River. A preliminary survey has been made for the entire line, and the engineers are now making the locating survey. Only a small force of men is engaged on the work at present. The men are being employed by the company, and probably no part of the extension will be built by contract. The work is light and there are no very heavy curves or grades. There is one iron bridge with a through span, 148 ft. long, between end pin centers.

GENERAL RAILROAD NEWS.

Atchison, Topeka & Santa Fe.—The gross earnings, operating expenses (exclusive of taxes and rentals) and net earnings of the road and its auxiliary lines for January were as follows:

	Gross earnings.	Operating expenses.	Net earnings.	Operated mileage.
Roads owned and controlled.	\$2,347,971	\$1,795,515	\$551,556	6,527
Roads jointly owned.				
Atchison's one-half.	126,778	139,622	D. 12,844	587
Total.	\$2,473,819	\$1,935,137	\$538,712	7,114

	Gross earnings.	Operating expenses.	Net earnings.	Operated mileage.
<i>St. Louis & San Francisco.</i>				
Roads owned and controlled.	\$489,035	\$308,737	\$180,298	1,329
Roads jointly owned with Atchison, Frisco's one-half.	124,211	131,333	D. 10,125	535
Total.	\$613,246	\$440,073	\$173,173	1,865
Aggregate—both systems.	3,087,065	2,378,210	708,885	8,979

The comparative statement of all lines is as below:

	Gross earnings.	Net earnings.	Per mile.	Gross earnings.	Net earnings.	Mileage.
Atchison System.	\$2,473,819	\$538,712	\$81.72	\$2,473,819	\$538,712	7,114.41
Jan., 1890.	2,279,162	682,316	\$80.55	2,279,162	682,316	7,110.23

	Gross earnings.	Net earnings.	Per mile.	Gross earnings.	Net earnings.	Mileage.
Inc. or Dec.	\$194,656	D. \$143,645	1.27.17	D. \$20.25		1.4.18
Friscos system.						
Jan., 1891.	\$613,246	\$170,173	\$328.78	\$613,246	\$170,173	1,865.22
Jan., 1890.	552,028	195,633	277.53	552,028	195,633	1,855.37

	Gross earnings.	Net earnings.	Per mile.	Gross earnings.	Net earnings.	Mileage.
Inc. or Dec.	\$61,218	D. \$25,461	1.31.23	D. \$14.20		1.9.85
Aggregated general system.						
Jan., 1891.	\$3,087,065	\$708,885	\$343.78	\$3,087,065	\$708,885	8,979.63
Jan., 1890.	2,831,190	577,989	315.78	2,831,190	577,989	8,965.66

	Gross earnings.	Net earnings.	Per mile.	Gross earnings.	Net earnings.	Mileage.
Inc. or Dec.	\$255,904	D. \$169,105	1.28.00	D. \$18.99		1.14.03

Cincinnati, Dayton & Ironton.—The railroad formerly owned and operated by the Dayton, Fort Wayne & Chicago, and which was recently sold by the Special Master Commissioner, has been reorganized by the purchasers, and will be operated by two separate companies. That portion of the line extending from Dayton, O., to Ironton, O., 112 miles, will be operated by the Cincinnati, Dayton & Ironton, and that portion of the line extending from Dayton to Delphos, O., 96 miles, will be operated by the Cincinnati, Dayton & Chicago. The general offices of both companies will be located at Dayton, O. The road between Dayton and Ironton is the old Dayton & Ironton, and that between Dayton and Delphos is the Dayton & Chicago. Since the consolidation of the two lines in 1887 the former has been called the Ironton Division and the latter the Chicago Division. The Chicago division is 3 ft. gauge and the other is standard gauge.

Fitchburg.—The State Executive Council of Massachusetts has accepted the offer of the company to settle the judgment recently obtained by the state against it for the rent due from the Southern Vermont Railroad up to the date of its sale, amounting to \$90,500, in four per cent. bonds maturing in 1920.

Middletown & Crawford.—The seven per cent. first-mortgage bonds maturing April 1 will be extended for 30 years at 4½ per cent., arrangements for that purpose having been effected. The bonds outstanding amount to \$66,000.

Pennsylvania.—The earnings of the company's lines for February were as follows: All lines east of Pittsburgh and Erie, as compared with the same month in 1890, show a decrease in gross earnings of \$111,771, a de-

crease in expenses of \$25,009, and a decrease in net earnings of \$88,102. The two months of 1891, as compared with the same period of 1890, show an increase in gross earnings of \$38,393, an increase in expenses of \$3,382, and an increase in net earnings of \$55,011. All lines west of Pittsburgh and Erie for February, 1891, as compared with the same month in 1890, show a decrease in gross earnings of \$340,937, a decrease in expenses of \$215,067, and a decrease in net earnings of \$125,870. The two months of 1891, as compared with the same period of 1890, show a decrease in gross earnings of \$428,856, a decrease in expenses of \$302,871, and a decrease in net earnings of \$125,977.

Philadelphia & Reading.—The earnings of the company for February were as follows: Gross traffic receipts, \$1,470,916; traffic expenses, \$889,423; profit in operating, \$581,493; net receipts from other sources, \$81,259, making the profit for the month \$662,752. Against this is charged \$51,033, expenditures for permanent improvements, and \$606,150 as one-twelfth of the current year's fixed charges, thus showing a deficit for the month of \$54,430, an increase of \$161,034 as compared with February, 1890, when there was a deficit of \$215,525. The surplus for the three months of the current fiscal year is \$162,185, an increase of \$380,724, as compared with the corresponding period of the last fiscal year, when there was a deficit of \$218,538.

Union Pacific.—The directors have decided to refund the present bonds of the main line and the branches, and will issue a new mortgage to cover the entire system, including the leased and controlled lines. None of the details of the mortgage have been arranged, and the company may not announce its plans until the next Congress meets, as the government debt must be included in any proposals for refunding the company's bonds.

TRAFFIC.

Chicago Traffic Matters.

CHICAGO, March 25, 1891. The result of the conferences held last week was an agreement on the part of the Atchison to take the Jacksonville Southeastern mileage matter in hand and endeavor to get the two-cent tickets out of the market by tomorrow. If this can be done, the Alton will withdraw its notice putting in effect a two-cent mileage rate over all its lines. The Wabash has withdrawn its tickets, and if the Atchison and Southeastern succeed in clearing the market, one of the most threatening obstacles in the way of harmony in the Southwest will have been removed. The Atchison has agreed to hold the Southeastern in line in other matters, and the outlook is considered promising. However, "there is many a slip," and until the Alton is finally satisfied that the market is clear it cannot be said that the matter is settled.

The impression is gaining ground here that the reported change in the ownership of the "Monon" is an accomplished fact, and that a change in the directory will be announced soon.

The interested lines have agreed upon a compromise in regard to passenger rates between St. Paul and the seaboard, by which the lines via Mackinaw are to be allowed a differential of \$1.50, in consideration of which they agree to maintain the same scale of rates as via Chicago.

The Central Traffic Association is endeavoring to stop the practice of advancing the cost price of ice and billing it as advance charges.

The meeting of the Board of Commissioners of the Western Traffic Association called for March 23 has been postponed until tomorrow.

Chairman Midgley, of the Western Freight Association, is investigating the matter of stopping hogs in transit at packing houses between the point of shipment and the destination for the purpose of making changes in the loads by taking out some and substituting other hogs.

The Central Traffic Association announces a rate of 12½ cents per 100 lbs. on dressed beef, carloads, Chicago to Fort Wayne, Ind. The Freight Committee have decided that Chicago rates should not apply from points in Michigan to lower Mississippi river points and Green Line points after April 1. The association has also decided to decline to pay any claims for overcharge in weights as ascertained at Pacific coast terminals until all undercharges are similarly reported, or it is shown that none have been collected.

A meeting of the Southwestern lines was held yesterday to consider a proposition to make the same freight rates from Milwaukee as from Chicago to Texas points via St. Louis. This question has been up before, but the Alton refused to agree on the ground that it would be an injustice to Chicago shippers, and it informed the other lines that, whatever rates they might make from Milwaukee, it would preserve the usual differentials from Chicago; which means, of course, that rates from Chicago proper will be reduced if deemed necessary.

There was considerable talk Monday over the discovery that the Kanawha dispatch and the Missouri Pacific had made a rate of 40 cents per 100 lbs. on sugar from New York to the Missouri River, the regular rate being 48 cents. It was thought that this was a secret cut, but it transpires that the Missouri Pacific has not neglected to file its tariff with the Commission. But it was a sharp trick on competitors. The change in the customs tariff law April 1 has the effect of starting very large shipments of sugar from New York westward, and the southwestern roads have been exercised over the matter several weeks, each suspecting its neighbors of a secret design to get an undue share of the traffic.

The first reports on this year's wheat crop are being gathered by the railroads. The Atchison, Rock Island and Burlington report a larger acreage in wheat than ever before, and that the wheat is in excellent condition. In Kansas the acreage is reported at thirty per cent. increase over last year, with fair prospects of fifty million bushels, against thirty-five million last year. S. T. K. Prime, the crop expert, reports but little grain in store in the West, and that the season on the whole is backward.

Messrs. Midgley, Goddard and Blanchard are investigating dressed beef rate manipulations on business originating at Missouri River points. The combined output of the Kansas City, Omaha and Sioux City slaughter houses is larger than that of those at Chicago, over five thousand cars having been shipped from these points since Jan. 1. The Canadian lines are getting a suspiciously large share of the traffic, and a large amount of the business is going via St. Louis and the Southern routes.

Traffic Notes.

The Trunk Line Executive Committee will probably establish a Bureau of Inspection at Buffalo, to watch eastbound freight and detect, if possible, the false billing

which is responsible for much manipulation in rates. It is said that billing to false destinations so as to permit absorption of arbitraries is considerably practiced.

Chairman George Blanchard, Chief Inspector Paul P. Rainer and Traveling Inspector E. E. Johnson, of the Central Traffic Association, have been summoned to appear before the Federal Grand Jury at Indianapolis and tell what they know about alleged violations of the law by certain railroads which are being investigated by agents of the Interstate Commerce Commission.

Under sharp competition of labor agents the second-class fares from Memphis to St. Louis were last week cut from \$7.55 to \$1, and to Chicago from \$12 to \$5, several cuts being made the same day. These reductions were undoubtedly manipulated under cover of labor contracts, but the Memphis reporters seem to have no doubt that the reductions came out of the railroads in the shape of commissions.

Acting Governor Loughton of Washington has vetoed a bill passed by the legislature of that state prescribing maximum freight rates on wheat and barley and their products, and potatoes and hay. He says that the bill discriminates against producers of other products, and against those districts of the state which do not produce these commodities; and violates the interstate commerce law by discriminating against grain growers in adjoining states.

At the recent annual meeting of the Western Car Service Association (Omaha), the oldest demurrage association in the country, there was loud complaint that the Wabash had been violating the rules, allowing too many days' free detention on cars of coal and lumber. Some of the other lines threatened to withdraw and the Wabash retorted that it had only been doing openly what others did secretly. It was finally resolved to lengthen the free time in certain cases on all roads, and matters again went on smoothly.

The first result of the Interstate Commerce Commission's report in the suit of Coxie Bros. & Co. against the Lehigh Valley is shown in better treatment of individual operators. The railroad company has not hesitated heretofore to notify operators to restrict their output. Coxie Bros. & Co. have now notified the Lehigh Valley that they will not observe requests to shut down, but will insist that the company, as a common carrier, shall furnish them with cars to carry their freight. The Lehigh Valley, it is said, has ordered a number of cars to the Coxie colliers in compliance with the demand of the latter.—Philadelphia Paper.

An intelligent and conservative Cleveland reporter gathers the following: "Chances for a big freight rate war in Central Traffic and Trunk Line Association territory are better now than they have been for several years, and conservative railroad men view the situation with apprehension. Some of the weaker lines have lost all fear of the interstate commerce law and are cutting rates vigorously. They seem possessed of a fever of madness to get business at any cost, while the strong lines are just now less able than usual to suffer this competition. Last spring there was an abundance of rate cutting, but it was ignored because all lines had all the traffic they could carry. Now there is not enough to go around. Not only are some railroad lines now manipulating rates on grain and provisions but on flour also."

The Interstate Commerce Commission.

The Commission has decided the case of Hamilton & Brown, against the Chattanooga, Rome & Columbus and other roads, in favor of the complainants. The rates on freight from interstate points to Kramer, Ga., have been made by taking the through rate to recognized basing points and adding thereto that local rate which would give the lowest combination. This method of determining a rate applied to Kramer, the Commission holds, operates as an unjust discrimination against that place. The railroads are directed so to adjust their tariffs as to remove this discrimination.

Ticket Commissions in Trunk Line Territory.

The Board of Rulings of the Central Traffic and Trunk Line Associations, composed of Chairmen Goddard, Blanchard, Donald, and Farmer, has begun operations under the recent agreement to boycott all connecting lines that continue to pay commissions to agents in the territory of those associations. The Board has told the Chicago, Burlington & Quincy that it has evidence that that road has been paying commissions to Eastern agents on February business, and demands either a denial or confirmation of the charge. The Burlington people have replied that, as no specific charge is made, no specific answer can be given; that they have not intended to ignore the agreement of the Eastern roads in regard to commissions, and have certainly paid no commissions to persons not asking for them. But they ask for some guarantee that the Burlington will continue to receive an equitable share of the passenger business from the East. The Board of Rulings intimates that unless the Burlington begins as early as March 31 to conform to the rule of the joint committee, the tickets of that road in the Eastern ticket offices will be turned to the wall. It is generally believed that nearly all Western lines are paying commissions in Eastern territory, and that some of the Eastern lines have themselves broken the agreement. The Board of Rulings has issued a supplementary notice to ticket sellers saying that the first order has not been strictly observed, and adding:

"Agents receiving circulars or letters from connecting railroad or transportation lines which offer to pay commissions in any form whatsoever will immediately transmit the same to the General Passenger Agent, and verbal advices of a similar nature will also be communicated by letter, with a full statement of the facts in each case."

Abolishing Unlimited Tickets.

Following are the resolutions adopted by the Passenger Committee representing all associations that met in New York last week; they are now under consideration by the roads:

"1. No single trip ticket of any character good between local or competitive points within the [an] association shall entitle the passenger to stop-over privileges."

"2. That all tickets sold between principal towns and cities within this association shall be limited not to exceed one day from date of issue, and that committees shall be organized at once to decide between what points it is practicable to put this rule in effect."

"3. That all coupon tickets issued by lines members of this association and reading to points on other roads shall be limited not to exceed twenty-four hours beyond regular schedule train time, and that no unlimited tickets shall be sold by lines members of this association to points on other roads."

"4. The question of limiting tickets reading between local points shall be left for the present for individual

action of each line until such time as a ticket can be prepared which the agent can handle quickly, conveniently, and safely in the limited time which an agent has for the sale of tickets while a train is standing in the station.

"5. Nothing is intended in the foregoing to interfere in any way with the present method of issuing and limiting tourist and excursion tickets and stop-over and other privileges granted on such tickets under agreement and local regulations of the different lines members of this association."

"In presenting the foregoing your committee has in mind: (1) The total abolition of the sale of unlimited tickets of any kind to points on other lines. (2) The minimizing as far as practicable of the sale of all unlimited tickets between local stations, and hope that each line may find some practicable method of limiting all single-trip tickets, whether sold to local or competitive points. In making suggestions as to the limits which shall be placed upon tickets your committee feels sure that it will be practicable to make a much closer limit than that suggested as the maximum in the foregoing."

"In conclusion, your committee earnestly hopes that its recommendations may get serious consideration and favorable action, as it is well known to all who are engaged in handling the passenger business of the railroads of this country that the sale of unlimited tickets has for years been one of the foremost agents in the demoralization of rates through outside agencies, and this, added to the opportunities for traffic in these tickets by dishonest employees, has helped more than anything else to deprive companies of additional revenue, which can be secured in closely limiting all tickets."

Chicane about Grain.

The Railroad Commissioners of Kansas have been on a trip to the western part of the state, where they have been looking after the needy settlers who have been asking for seed wheat. It is said that they found at least two-thirds of those who were anxious to get relief were not in need of help. Judge Humphrey found in one county 340 farmers who were asking for aid, and, on investigation, he cut this number down to 21. It is believed that there was a systematic effort on the part of these farmers to get their philanthropic brethren of the East to send them aid when they were already in good circumstances.

Cattle Regulations in the Rocky Mountains.

The Fort Worth & Denver has issued a circular of regulations governing the admission of Southern cattle into Colorado, Nebraska, Kansas and New Mexico. The laws of these states are quoted, and a map accompanies it, showing the location of the quarantine lines of the states and territories; also the government fever line as fixed by the Department of Agriculture. Wyoming still insists upon an examination of affidavits at Cheyenne. These will be taken up by the agent at the loading point and forwarded with the stock. Colorado, Wyoming and Montana have this year agreed upon joint regulations and inspection, which promise to curtail the expense of a compliance with the regulations to a minimum. One inspection only will be required, and this will be made before the cattle are loaded. The Fort Worth & Denver officers expect that the cattle will begin to move about April 1, and they are preparing to handle 100,000 head for points in Wyoming and Montana.

Nebraska Rate Law.

The Nebraska legislature has passed a maximum rate bill. Its details are not yet published, but an officer of a Western road says that the reductions ordered will average over 20 per cent.

California Traffic.

The through passenger traffic over the lines of the Southern Pacific system for the month of February was as follows:

	First class.	Second class.	Grand total.
Eastward.....	1,597	1,837	3,434
Westward.....	2,679	3,286	5,965
Total.....	4,276	5,123	9,399

For the first two months of the year the totals compared as follows:

	1890.	1891.
Arrivals.....	8,741	12,260
Departures.....	6,228	6,537
Total.....	14,969	19,097

The shipments of California fruit overland for the first two months of the year were as follows:

	Tons.
Canned goods.....	1,194
Dried fruit.....	1,180
Ripe fruit.....	1,428
Raisins.....	906

Total.....	5,008
In 1890.....	4,263

The ripe fruit shipments embraced 1,097,800 lbs. citrus fruit from Los Angeles and 635,700 lbs. from Colton.

East-bound Shipments.

The shipments of east-bound freight from Chicago by all the lines for the week ending Saturday, March 21, amounted to 76,392 tons, against 77,693 tons during the preceding week, a decrease of 1,301 tons, and against 96,089 for the corresponding week of 1890, a decrease of 19,697 tons. The proportions carried by each road were:

	Wk. to Mar. 14.		Wk. to Mar. 21.	
	Tons.	P. c.	Tons.	P. c.
Michigan Central.....	9,116	11.9	9,548	12.3
Wabash.....	4,867	6.4	3,925	5.0
Lake Shore & Michigan South.....	10,999	14.4	10,368	14.0
Pitts., Ft. Wayne & Chicago.....	7,787	10.2	6,448	8.3
Chicago, St. Louis & Pitts.....	8,071	10.6	6,908	8.9
Baltimore & Ohio.....	4,786	6.3	5,526	7.1
Chicago & Grand Trunk.....	13,551	17.7	14,325	18.4
New York, Chic. & St. Louis.....	10,245	13.4	11,786	15.2
Chicago & Atlantic.....	6,970	9.1	8,366	10.8
Total.....	76,392	100.0	77,693	100.0

Of the above shipments 4,285 tons were flour, 41,531 tons grain, 6,336 tons cured meats, 3,234 tons lard, 7,799 tons dressed beef, 1,126 tons butter, 800 tons hides, 236 tons wool and 6,623 tons lumber. The three Vanderbilt lines together carried 39.7 per cent., while the two Pennsylvania lines carried but 20.8 per cent.